BRITISH BATTLE TANKS

DAVID FLETCHER

WORLD WAR I TO 1939

Osprey
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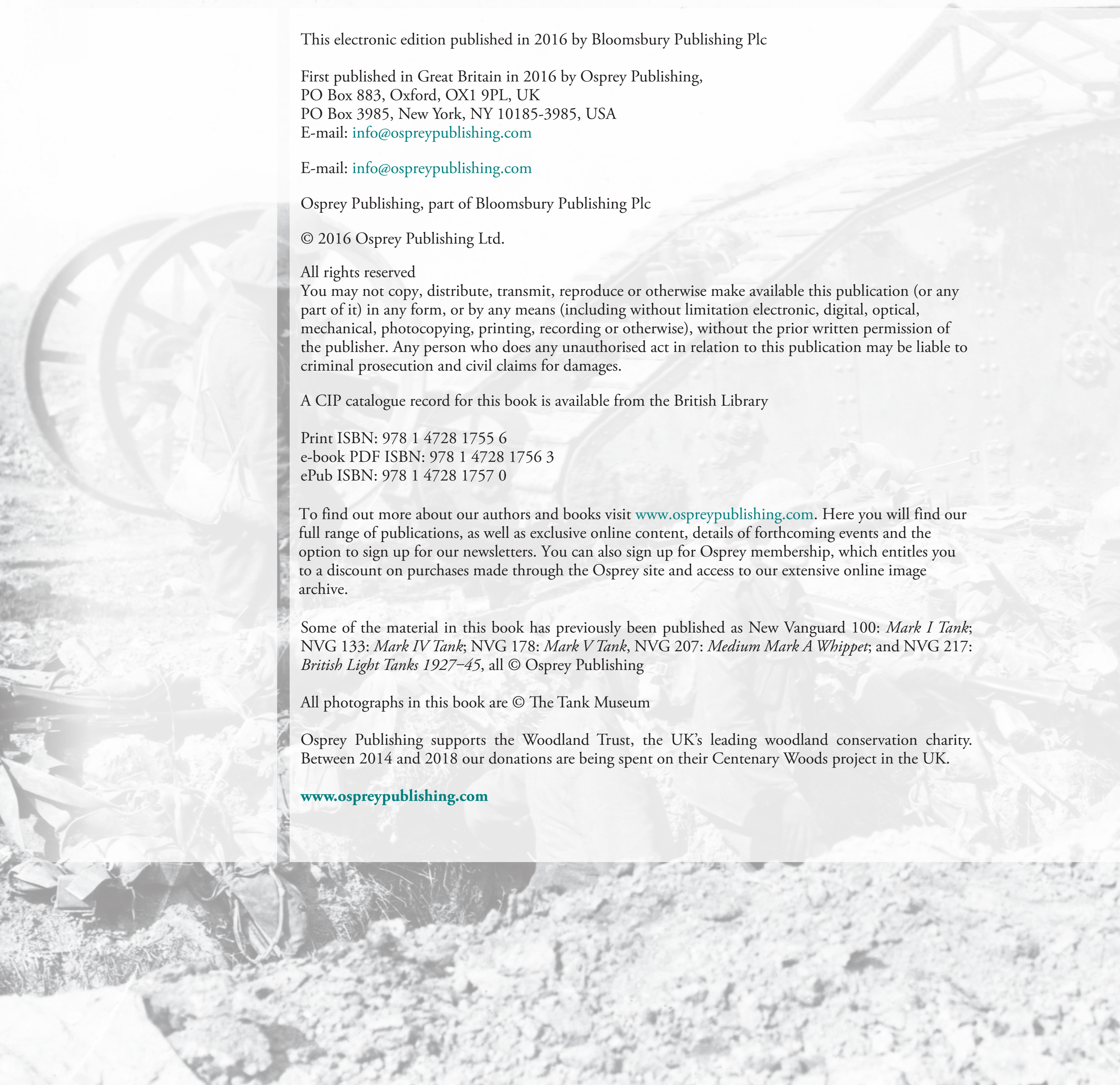
BRITISH BATTLE TANKS

THE FIRST WORLD WAR

DAVID FLETCHER



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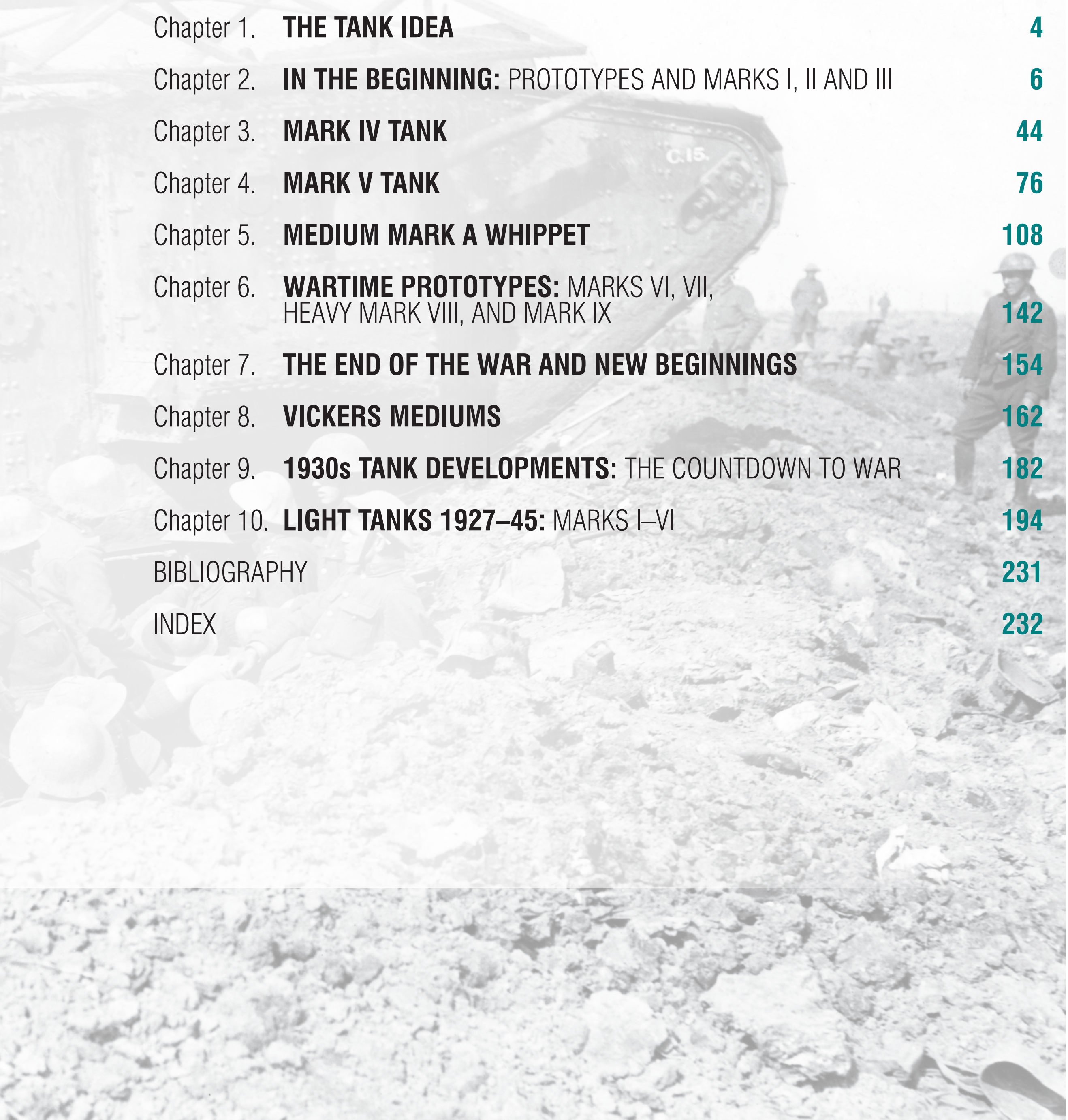


Wm FOSTER & Co Ld
ENGINEERS
LINCOLN

CHAPTER 1

THE TANK IDEA

The idea of the tank – a vehicle from which men might deal out death and destruction while remaining invulnerable themselves – is as old as recorded history. Examples range from the 'chariots of iron' mentioned in the Bible to the huge *Kreigsstellungszerstorer* designed by the German Kaiser in 1897, by way of Leonardo da Vinci's well-known 'tank' of 1482 and James Cowen's 'Land and Sea Locomotive Steam Ram and Battery' of 1854, at the time of the Crimean War. Each relied for its source of power on what was available at the time, from horses to man-power to steam. There have been hundreds of these tank ideas, all designed and sometimes even built with this same purpose in mind, but in the long run none was of any real use until the advent of the 20th century.

Then two things occurred. First, the internal combustion engine was perfected as a compact source of power, and this was followed by the development of working crawler or caterpillar tracks (such as those designed by J. Bramah Diplock in 1911). With the advent of these two emerging technologies, the idea of what was to become the tank came to the Austrian designer Gunther Burstyn in 1911 and the Australian Lancelot de Mole in 1912. All that was really needed was the additional impetus of a full-scale war to focus official minds, and that came about in 1914.

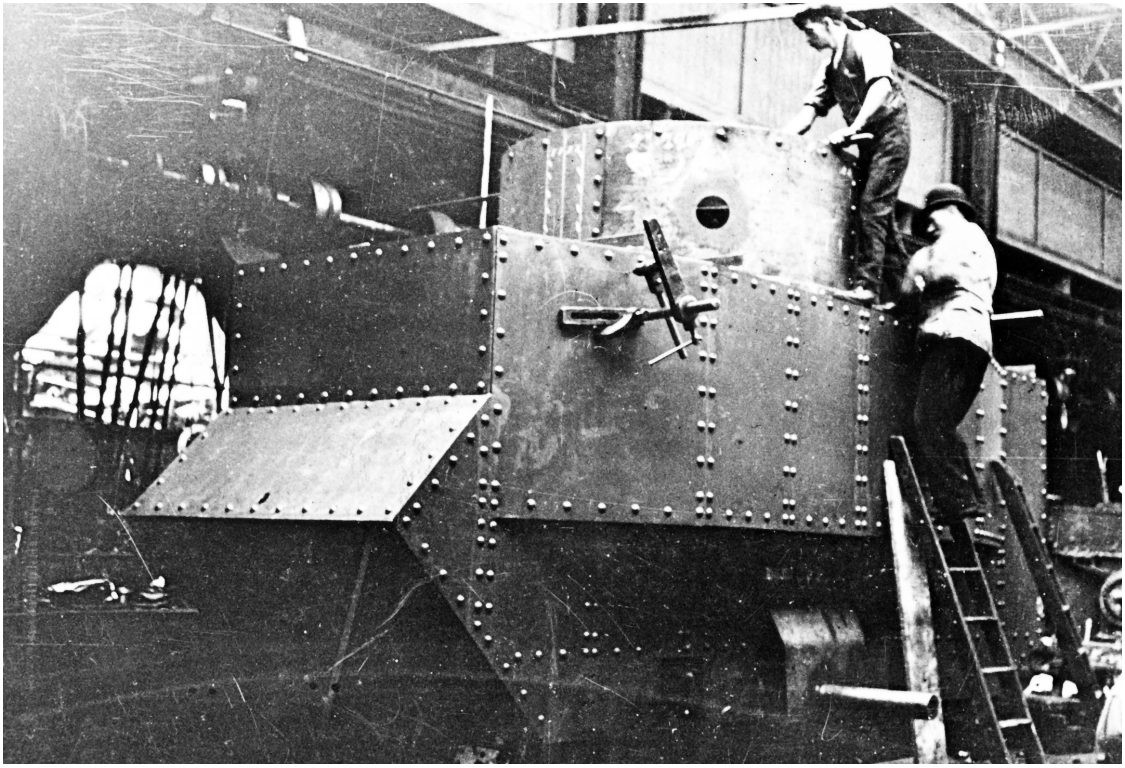
Science-fiction writers played their part too, notably H.G. Wells with his influential short story *The Land Ironclads*, which appeared in the *Strand Magazine* in 1903. But it was war, or the proximity of war, that seems to have inspired inventors. Friedrich Goebel, a German engineer living in Riga, came up with the idea of a walking armoured vehicle in 1913, which was rejected because it could not steer. In France various ideas were tried in 1914, all of which seem to have been rejected, while in Britain many of the earliest concepts, by Winston Churchill, Maurice Hankey and Colonel Crompton, were no more than ideas, doomed to failure. Only a contraption known as the Tritton Trench Crosser was actually built, but construction was slow and by the time it was finished better ideas were in the air.

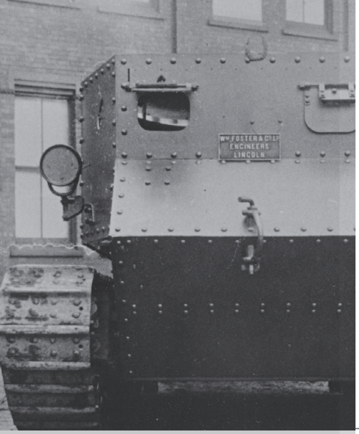
It was really Winston Churchill's creation of the Admiralty Landships Committee that got things started in Britain. It met for the first time on 22 February 1915 and gradually brought together all those with an interest in the subject. Colonel R.E.B. Crompton was put in charge of the development of a tracked landship, while William Tritton (of the agricultural machinery company Fosters of Lincoln) was ordered to design a wheeled one. Neither got very far. Tritton's scheme went first, shot down in flames in June 1915, while Crompton, having come up with a series of designs, was getting nowhere and his slow, methodical approach irritated some members of the Committee, who passed the project on to Tritton, supervised by Walter Gordon Wilson on behalf of the Admiralty. Their first design, the Number One Lincoln Machine, underwent its first trials in September 1915, but it was a failure, mostly due to its American tracks. It was rebuilt as Little Willie in November 1915 and, fitted with new tracks designed by Tritton, it was eminently serviceable – but already obsolete.

It was due to be replaced by an entirely new design by Walter Wilson. Enveloped in its own tracks, it was the distinctive shape of things to come. Although officially named His Majesty's Land Ship *Centipede*, it was more commonly known as Mother. It was thoroughly tested early in 1916, and resulted in the first production order for 100 tanks, later to be expanded to 150. These were used in action for the first time on 15 September 1916.

The French, meanwhile, had been making progress of their own. Following trials of a 45hp Holt tractor from America the engineer Eugène Brillié of the firm Schneider et Cie of Le Creusot had designed a form of armoured tracklayer capable of cutting through barbed wire and crossing trenches. An order for ten machines was placed on 15 December 1915. Subsequently Colonel Jean-Baptiste Estienne made contact with Brillié and convinced him that a vehicle that was both armed and armoured made more sense, so the Schneider design was redrawn to incorporate a 75mm gun. Four hundred of these were ordered on 25 February 1916, but delays in production meant that it was 16 April 1917 before they could be used in action. Meanwhile the British had pre-empted the initial surprise that Estienne was counting upon.

The Number One Lincoln Machine takes shape inside Foster's Wellington Foundry. Two fitters are working on the turret. The shaft near the bottom is the pivot upon which a Bullock track unit will be mounted in due course.





CHAPTER 2

IN THE BEGINNING

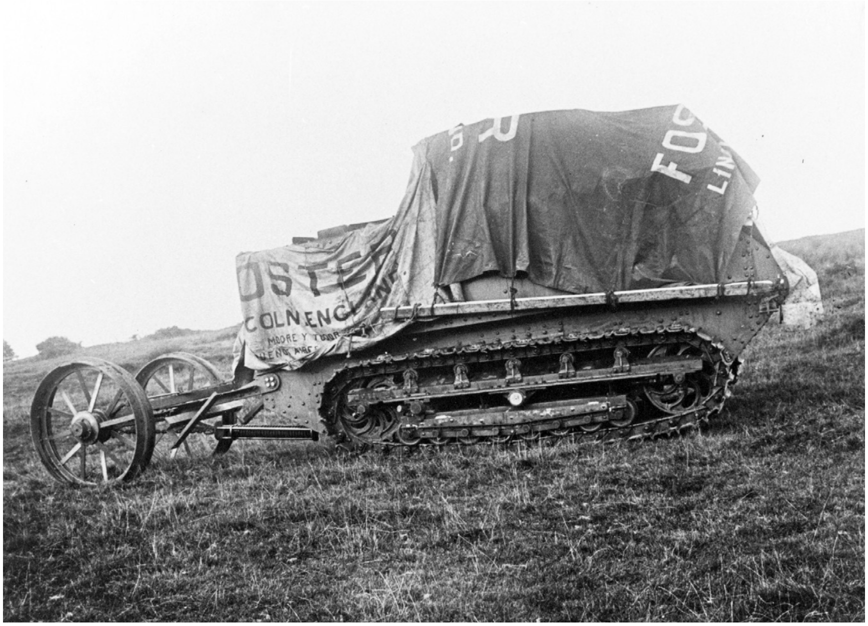
PROTOTYPES AND THE MARKS I, II AND III

THE MARK I TANK

In August 1915, a set of crawler tracks, manufactured by the Bullock Creeping Grip Tractor Company of Chicago, arrived at Liverpool docks for onward shipment to the city of Lincoln. The project that they were destined for had begun as an Admiralty scheme, inspired by the First Lord, Winston Churchill, with the creation of the Landships Committee in February 1915.

In fact the shipment from Chicago was not just lengths of track but complete sets of tracks, frames, sprockets and rollers all ready to fit to a design then under construction in England. They were stretched versions of a system that the Bullock Company manufactured for their range of agricultural tractors. Each set comprised a girder frame with a driven sprocket at the back, an adjustable idler wheel at the front and a system of small rollers, on a sub-frame, running along the tracks at the bottom. Additional rollers at the top supported the return run of the tracks. Compared with some other types manufactured in the United States, the Bullock tracks were not constructed to very high standards and appear to have been entirely devoid of any springs. The track links were formed from single-piece manganese steel castings, about 24in wide on the outer face and joined by pins.

William Tritton, managing director of William Foster & Company of Lincoln, had accepted a contract from the Admiralty for the construction of a prototype landship, which was to be fitted with the imported American tracks. As soon as he saw the tracks Tritton expressed doubts about them, doubts that were shared by his colleague, Walter Wilson. A naval officer with a fascinating engineering background, Wilson had been posted to Lincoln to cooperate with Tritton and oversee the work



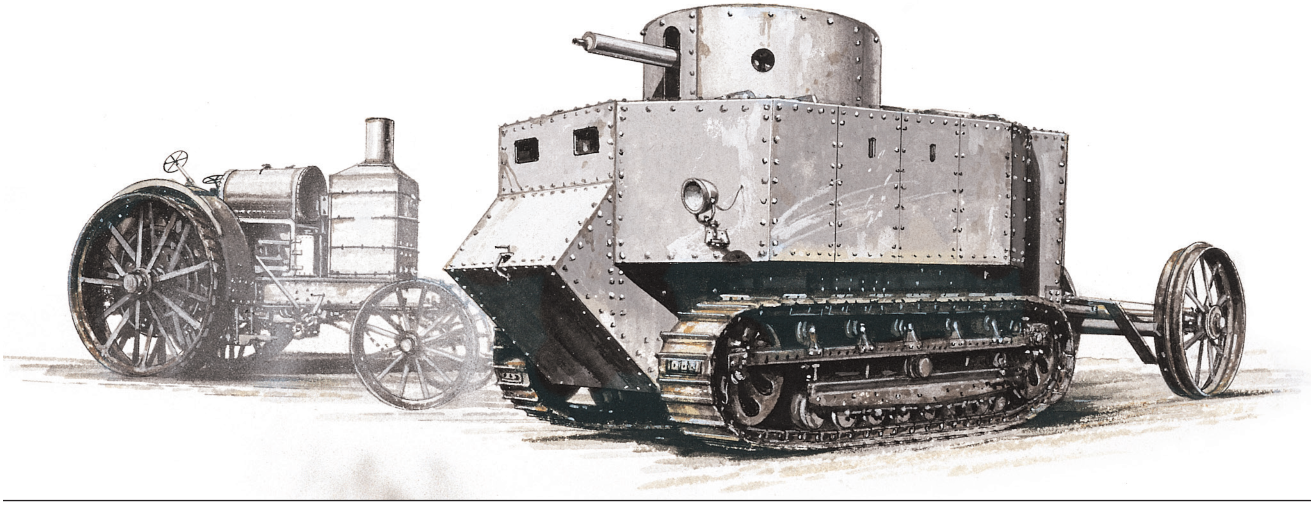
Draped with tarpaulin covers to disguise its warlike purpose, the Lincoln Machine is shown during trials. This photograph was taken after the tracks had been modified, but they still proved unsuitable for the work they would have to do.

on behalf of the Admiralty. It was these two men, so unalike in temperament, character and background, who became the formidable team which, within a further six months, adapted a crude concept into a viable prototype for an entirely new weapon system.

THE NUMBER ONE LINCOLN MACHINE

Their first effort, known as the Number One Lincoln Machine, was completed, up to a point, and moved on its tracks for the first time on 9 September 1915 in the yard of the Foster Company's Wellington Foundry. It comprised a riveted steel body, surmounted by a drum-shaped turret, running on the imported tracks. One early source claims that the turret was not intended to rotate, but if that was so there would have been no point in making it drum-shaped. Maybe this was true of the prototype for purely practical reasons, but one imagines that this would have been changed had it gone into production.

The vehicle was powered by a British Daimler engine and entire transmission, derived from the huge Foster-Daimler tractors that Tritton's firm had already built for the Royal Marine Artillery. Trials revealed that the tracks would not work, as Tritton and Wilson had foreseen. Those fitted to the commercial tractors were a good deal shorter, so the fact that they lay flat along the ground was not a problem. In this longer form it was a different matter. The extended ground contact meant they would not steer easily, so Tritton came up with a modification which he described as a 'fish belly' shape. This involved altering the position of the lower rollers so that the tracks presented a slightly curved surface to the ground, thus reducing lateral resistance. Even so this only solved one problem; there were still two more. To begin with, the imported tracks were not really robust enough to carry a load in the region of 16 tons, and in any case they also showed a tendency to sag away from the track rollers when the machine attempted to cross a trench. As a result, more often than not, they failed to realign themselves on the far side of the trench, bringing the vehicle to a halt in a most awkward location.



NUMBER ONE LINCOLN MACHINE in the yard of Foster's Wellington Foundry in Lincoln

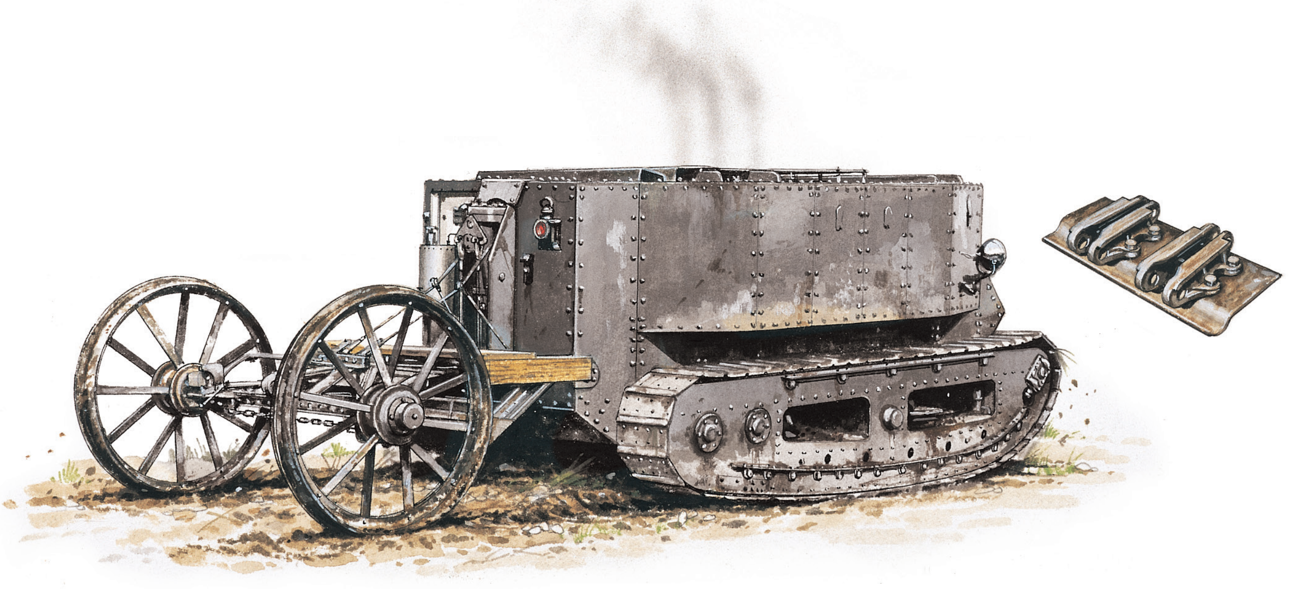
Very few people can ever have seen the Lincoln Machine like this; for most of the time it would have been shrouded in canvas. Grey seems to be a logical colour for any machine built to Admiralty requirements, but it was also applied by most engineering companies as a primer for photographic purposes before new products were finished to customer requirements. The tracks and suspension units, having come from the USA, could well be a different shade. The shape of the turret is known, but there is an element of speculation where the gun is concerned; it may well have been a dummy. In every surviving photograph of the complete vehicle, tarpaulin wagon covers obscure the entire turret and upper hull in an attempt to disguise the machine's purpose. These covers would also appear to mask the exhaust outlet and radiator ventilation. The tail assembly is very crude, pivoted to the rear of the hull and held in tension by a single spring attached low down at the back. The machine's mechanical components, engine, transmission and radiator, were all derived from the Foster-Daimler heavy artillery tractor, which was also manufactured at the Wellington Foundry. (Art by Tony Bryan, © Osprey Publishing)

WILSON'S BIG IDEA

Up to this time the project had been exclusively promoted, albeit somewhat reluctantly, by the Admiralty. The War Office had been playing about with similar concepts but to no particular purpose, much to the dismay of one Army officer, Colonel Ernest Swinton. A Royal Engineer, Swinton had been advocating a mechanical solution to the problems of trench warfare since 1914, but he had not got very far. Sent to observe the new contraption in Lincoln, on behalf of the War Office, he was at once inspired and dismayed; inspired that the project had got so far without his knowing about it, but depressed by its poor performance. Sensing this, Tritton and Wilson guided the Army officer towards a locked shed, inside which he was shown a wooden mock-up of Wilson's big idea.

Larger and bulkier than the prototype, this new design was characterized by the way the tracks appeared to run all the way round its body. It is the measure of Wilson's genius that he appreciated, even before the War Office specified it, that a machine intended to drive over rough ground and cross trenches must have maximum potential mobility. This was all very well, but it was also perfectly clear that, unless they could do something about the tracks, the idea would go nowhere. Here was the nub of the problem.

Since very few British firms were producing crawler-tracks, and none of them suitable for this purpose, the designers had relied upon American products that were altogether more advanced. Even so, these had been designed for agricultural work whereas the tracks required for this new machine had to be stronger and a lot more



LITTLE WILLIE during trials in Burton Park, Lincoln

In its second form the machine would have been a uniform shade of grey. This rear three-quarter view shows the steering tail assembly and hydraulic lifting device by means of which it could be raised clear of the ground. In later life the vehicle ran without its tail. The turret has now gone, to be replaced by a circular plate. Little Willie carried no visible markings, the name and date seen on the vehicle today appear to have been added between the wars. Even so, the manufacturers provided a cast plate reading 'Wm. Foster & Co. Ltd. Engineers. Lincoln', which still survives.

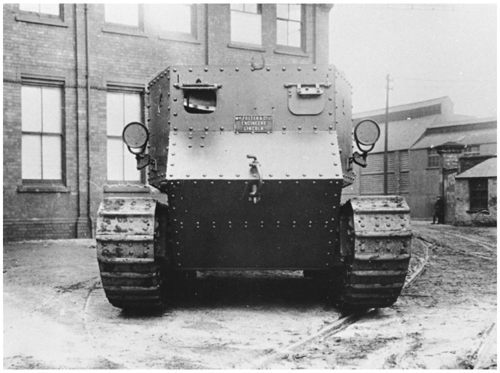
Judging from original photographs it would appear that smaller fittings such as the hinged flaps over the front apertures and the moveable covers that protect the weapons ports on either side were only added when the machine was rebuilt. A curious detail concerns the headlamps that were located lower down on Little Willie, although the original bolt holes, subsequently filled, can still be seen. The front lamps appear to be electric while the light at the back was probably acetylene. A sample track link is shown, revealing the arrangement on the inner surface. (Art by Tony Bryan, © Osprey Publishing)

adaptable. Tritton and Wilson embarked upon a frenzy of invention and succeeded, in a matter of days. They were able to announce the success of Tritton's final track design on 22 September 1915.

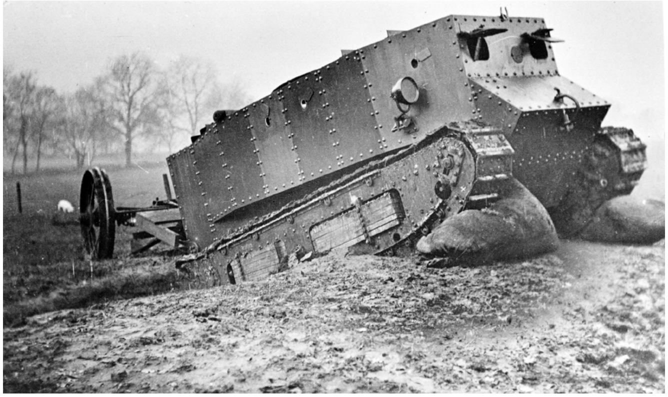
Mundane as it might seem, this was the single most important factor in the evolution of the British tank. Tritton's invention made Wilson's imaginative design possible, since it freed the designers from any constraints imposed by the use of ready-made commercial tracks. A set of tracks was rapidly produced for the Lincoln Machine, which was now renamed Little Willie, and it was soon able to demonstrate that they worked. For obvious reasons the two pioneers were by then heavily engaged on Wilson's improved design and Little Willie was already history. The turret was removed, the aperture plated over and it was only used to test the new tracks. Even so, it warrants a brief description.

LITTLE WILLIE

Christened, according to some, with a derogatory nickname for the German Crown Prince Wilhelm, this prototype of all tanks looks, at first glance, little more than a box on tracks and its general appearance can be seen from the illustrations. Internally the space was dominated by the mechanical components. Very little thought appears to have been given to the crew, but this was clearly not the first consideration. Two long girders ran the full length of



The Lincoln Machine rebuilt as Little Willie. Tritton's new tracks were just 20.5in wide, which became standard for all the early tanks. The driver's visor is open, its companion closed and the front machine-gun aperture covered by a round metal plate.



For trial purposes ballast weights were carried in the track frames to simulate the weight of turret and armament. This photograph, taken in Burton Park, shows Little Willie crossing a shallow trench and tackling two large sandbags, representing the parapet.

the interior and in effect formed the chassis. The engine was located at the rear, driving forwards, presumably to leave a modest amount of space beneath the turret, which was somewhere near the centre. The Daimler engine was a massive straight-six that employed the Knight sleeve-valve system. It was of 13-litre capacity but, for all that, the best it could produce was 105hp at 1,000rpm. It was petrol-fuelled, by gravity feed from two tanks located towards the rear of the hull.

Drive from the engine passed forwards through a cone clutch, incorporated within the flywheel, into a two-speed and reverse gearbox and from there into a massive differential casing from which drive passed, via a series of sprockets and chains, to the track drive sprockets at the rear. Ahead of the differential was a narrow shelf with seats that accommodated the driver, sitting on the right, and another crew member on his left who operated steering levers. These levers operated band brakes on the output shafts of the differential, slowing down one track or the other as required. At the rear, on the right, was the huge, box-shaped radiator.

If the turret had been retained it would probably have mounted the Vickers 2-pdr pom-pom for which, according to one source, 800 rounds of ammunition would have been supplied. This same source mentions a Vickers-Maxim machine gun, which would have been located at the front of the hull, and Lewis guns for the loopholes along the sides, although it is claimed that the Danish Madsen was also considered.

The track frames had openings in the sides that acted as mud chutes and the frame also featured a series of rollers around which the tracks ran. The sprockets were at the rear and there were adjustable idler wheels at the front on each side. The tracks, as designed by Tritton, consisted of large plates, virtually flat but with a lip along one edge, which were riveted to internal castings. These not only connected one to another by pins, they also slotted into flanges on the faces of the frames that prevented them from dropping away when the vehicle crossed a trench. The most unfortunate result of this was that the vehicle had no springing at all; it simply bumped and clattered along its tracks as they lay on the ground. The track frames were, however, attached to the body of the machine by large spindles at the centre so they were free to swing, to a modest extent, in relation to the hull.

In his original specification for the Number One Lincoln Machine Tritton had suggested that it should be steered by wheels, which extended from the back like a tail and acted, in effect, like the rudder on a boat. This idea was retained for Little Willie, although the entire assembly could now be raised and lowered by means of a hydraulic system attached to the back of the body. This served two purposes: by lifting the tail free of the ground it was easier to swing the vehicle on its tracks alone using the steering brakes while, by adjusting the ground pressure, it would alter the centre of gravity when the machine tackled an obstacle.

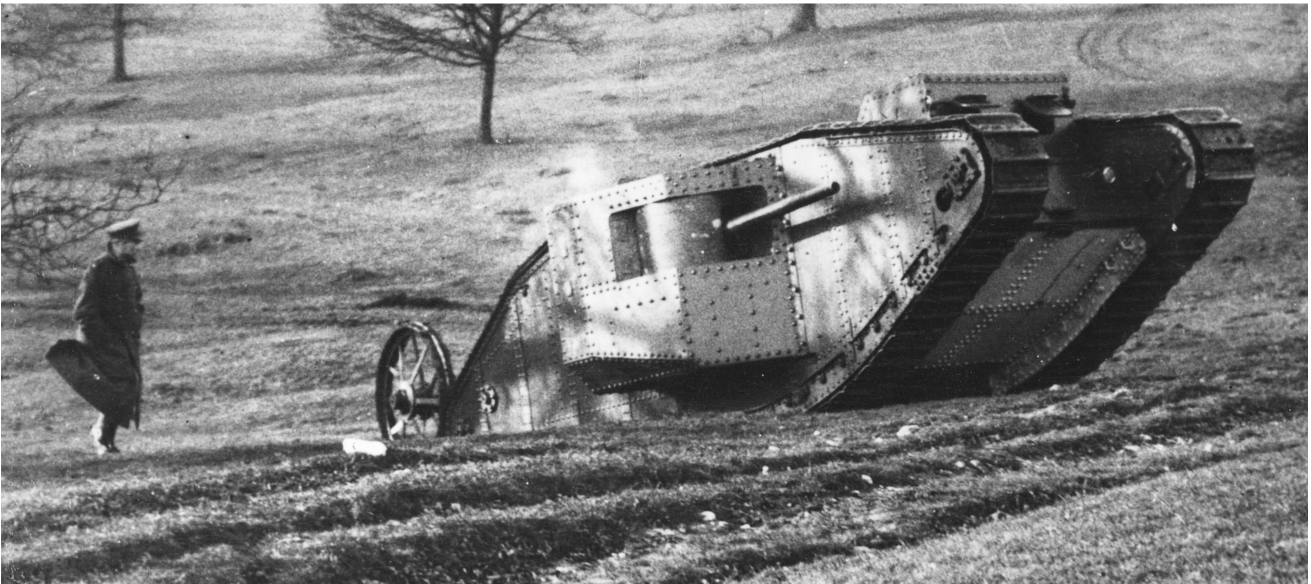
BIG WILLIE

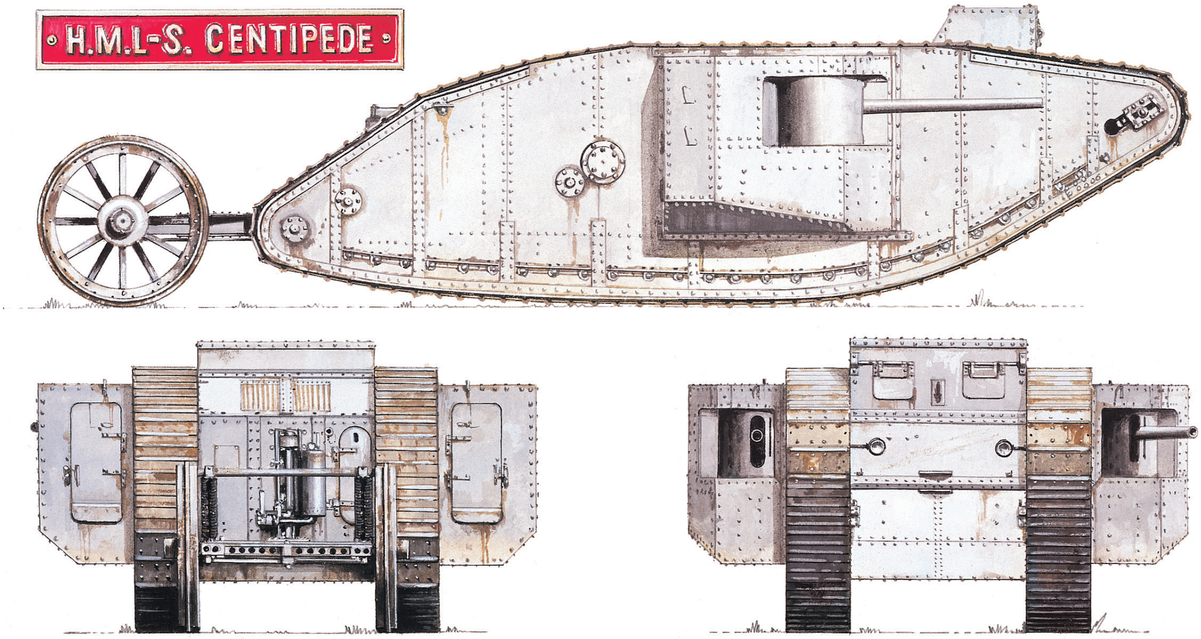
The full-size wooden model of Wilson's design for an all-round track machine, which Swinton had seen in Lincoln, was brought up to London in September 1915 and shown to War Office representatives at Wembley Park. To what extent it looked like the tank, as ultimately built, we do not know, since no photograph survives. One witness described the weapon sponsons, fitted to the sides, as looking like bow windows, but since the matter of the weapons to be carried had not then been settled this does not signify very much. The final appearance was revealed when the prototype was inspected at Fosters in December, but it could not be described as complete until it arrived at Hatfield Park in Hertfordshire in January 1916, for its official trials.

Outwardly it was a dramatic departure from the profile of Little Willie, although in fact the two machines had a lot in common. Indeed, the massive, lozenge-shaped track frames that created the new tank's distinctive silhouette were just enlarged versions of the type fitted to the first machine. Even the body itself was more or less the same shape, except for the raised cab at the front; only now it was sandwiched between the frames, rather than riding on top of them. These frames were extended fore and aft to give an improved trench-crossing capability to meet new War Office requirements and where they protruded, ahead and behind the body, these extensions were referred to as horns.

Various weapons had been considered, but there was inevitable conflict between what was ideal and what was available. In the end the Admiralty came up with a stock of spare weapons. Known as the Six Pounder, Single Tube, this was a 1915 modification of a Hotchkiss 57mm design first taken into service by the Royal Navy in 1885 as a quick-firing gun, the term referring to a piece with quick-action breech that took a complete round. It had a long (89.76in) barrel, a maximum range of 7,500 yards and a muzzle velocity of 1,818ft/sec.

The problem of fitting the weapons was exacerbated by two factors. The tall narrow shape of the machine meant that a turret on top could raise the centre of gravity dangerously high; the way the tank was laid out inside meant that it would have to be located directly above the engine, leaving no room for a gun crew who might well have been cooked alive in any case. On advice from the Director of Naval Construction, Eustace Tennyson d'Eyncourt, the designers adopted side-mounted sponsons, not unlike the system used on some warships of the period. The sponsons took the form of wedge-shaped structures hanging from either side of the hull. A gun was mounted in each, fitted to a pedestal base that gave it a 100-degree arc of fire. A curved shield, fitted around the gun and moving with it, sealed off the aperture, although there was a vertical slit in the shield for a simple telescope sight which was also attached to the gun mounting. Traverse and elevation were entirely manual,

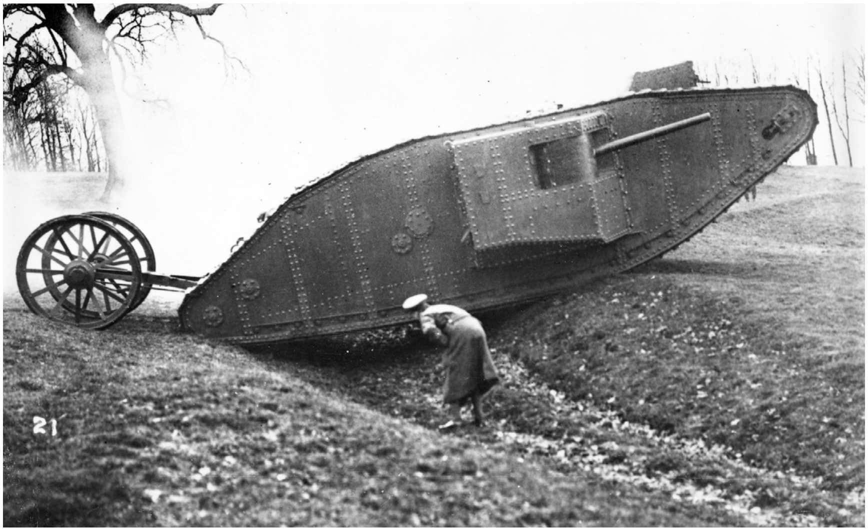

Mother in Burton Park. The front of the cab is virtually identical to that of Little Willie, but the tracks are now the dominant feature and they limit the driver's view. The weapon sponsons, on the other hand, look like a clumsy afterthought.



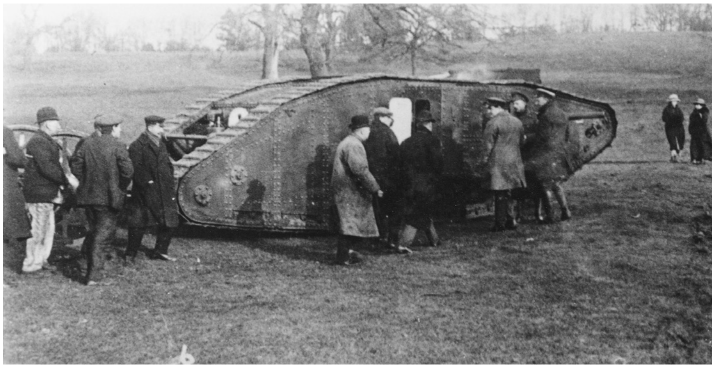
HIS MAJESTY'S LAND SHIP *CENTIPEDE*; a.k.a. Big Willie or Mother

The prototype of all rhomboid-shaped tanks also appears to have left Foster's in a coat of grey. The tank was, however, painted white on the underside at the front, including the inner track frames, and this seems to have been done in order to provide observers with a better view of its obstacle-crossing capabilities. The method of construction, riveting steel plates to an internal framework, is made more obvious when the rivets are set at boiler-makers' pitch. It would appear that the only permanent machine-gun mounting was located in the front of the cab, but it is assumed that the hinged flaps near the rear of each sponson could be temporary firing points.

According to a programme issued when the machine was first demonstrated, it was constructed of nickel steel plate, 12mm thick on the front of the cab and 10mm at the sides. The sides and rear of the hull were 8mm thick and the roof and belly 6mm. The same programme quoted a rate of fire of between 15 and 20 rounds per minute for the 6-pdr gun and 250 rounds per minute for the Hotchkiss machine gun. Only the nameplate now survives, at the Tank Museum. (Art by Tony Bryan, © Osprey Publishing)



In this near-perfect side view the close pattern of rivets shows up well and the sponson appears to be much more a part of the design. The bearing caps just in rear of the sponson indicate the location of the secondary gear shafts.



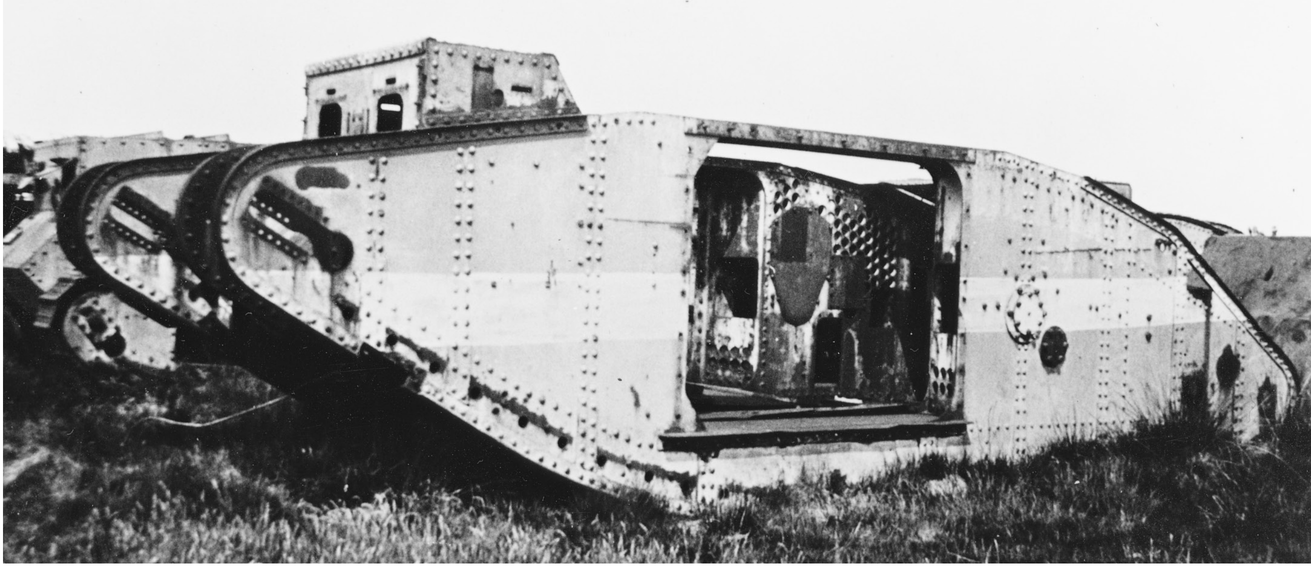
Tritton, Wilson and Stern are among the group gathered around Mother's starboard sponson. Notice how the door swings outwards but against the hull. The small, oval door at the rear is also open and can just be seen over the tracks.

aided by a folding stock that tucked under the gunner's right arm, and there was a pistol grip and trigger for firing. The loader served the gun from the right, with the gunner on the left so there was a slight difference in the design of the two sponsons to prevent the crewmen being squashed. This in turn affected the movement of the guns so that the starboard side weapon could fire from dead ahead to 110 degrees to the beam while the arc of fire on the port side was from 5 degrees off dead ahead through to 115 degrees.

Known officially as His Majesty's Land Ship Centipede, this machine, which the Admiralty also called Big Willie, has always been better known to history as Mother. Compared with Little Willie it appeared to be slightly more spacious inside due to the extra room created by the sponsons. It employed the same Daimler engine, gearbox, differential and radiator as the original model, but these had been turned around and relocated. The engine was now situated somewhat forward of the centre, driving back through the clutch and gearbox to the differential at the rear. The radiator, with its attendant cooling fan, was located more or less centrally at the back. This, however, is where the similarity ended.

Little Willie weighed something in the region of 16 tons, but with its larger frames, sponsons and guns, Mother tipped the scales at 28 tons. Tritton and Wilson were convinced that a greater range of gears would be needed to cope with the extra weight, so they introduced auxiliary gearboxes in the track frames just behind the sponson openings on each side. Thus drive from the differential now passed through these secondary, two-speed boxes and from them to the sprockets at the rear via heavy-duty roller chains. Working under pressure, the designers simply adapted typical traction engine gearboxes for this task, so as a result there were exposed gears and shafts, worked by direct-acting levers, within the hull frames of the tank. In addition to providing extra speeds (four forward and two reverse in theory) these gears had a second and, in many respects, a more practical use in connection with the steering, which will be described shortly. Mother also sported a steering tail and track brakes as provided for Little Willie; the tail wheels had a raised central rib around the circumference, which was supposed to cut into the ground surface in order to grip, and in theory would guide the tank in a 60ft radius curve. Steering this way was hard work and only partially successful since it depended very much on the condition of the ground.

Both Little Willie and Mother were of riveted construction except for certain areas, such as the roof, which was bolted. This enabled panels to be removed if it proved necessary to lift out the engine. The body of the tank, main hull and track frames, consisted of a framework of girders to which the plates were attached. It should be pointed out that for both prototypes no armour was fitted, in the sense of bullet-proof plate. Rather panels of ordinary steel were used, normally referred to as boilerplate. Little Willie was constructed with the rivets spaced at girder-makers' pitch (roughly 5½in apart), but for some reason, when Mother was built the rivets were set at boiler-makers' pitch. This is much closer, to achieve a water-tight joint in boilers, and could have advantages in a tank. For one thing it would make the structure that much



Stripped to a bare hull, with no sponsons and the top plates missing, Mother was retained with other preserved tanks at Bovington after the World War I, but was subsequently broken up for scrap. The stripe along the side was an identifying mark from the Oldbury Trials of March 1917.

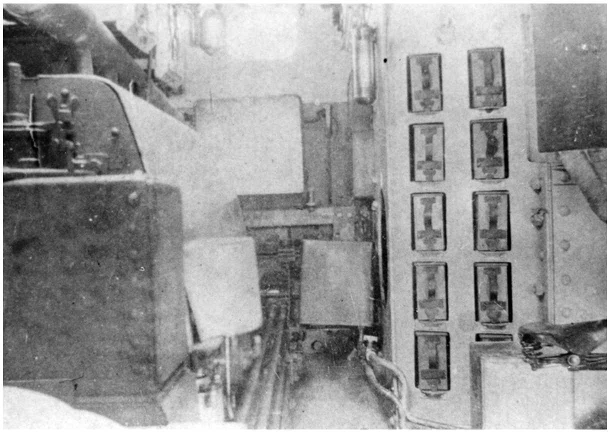
stronger and it would also ensure a better fit of plates, thus reducing the risk of splash from impacting bullets squeezing through. Disadvantages might be extra weight and longer production time. Whatever the reason this feature is peculiar to Mother; none of the subsequent production tanks were treated in this way.

On 29 January 1916 the new machine gave a demonstration of its capabilities in the grounds of Hatfield House. It tackled trenches, shell holes, swampy ground and wire entanglements without a hitch and appears to have impressed everyone who saw it. Four days later it repeated this before a distinguished audience that included Field Marshal Kitchener who, to the dismay of those present and the confusion of historians ever since, made an unfortunate remark about a 'pretty mechanical toy' before leaving; a strange contrast with his strong advocacy of air power. Ten days later the Army Council placed an order for 100 machines, which were now being referred to by the code name of 'tanks'. The order was split between Fosters of Lincoln and the Metropolitan Carriage, Wagon and Finance Company of Birmingham, although one source claims that seven were assembled by Robey and Company, also based in Lincoln. By this time the project had been transferred to the Ministry of Munitions, although the Admiralty continued to supply personnel for testing and experimental work. Clearly from now on the machines would become the responsibility of the War Office.

BUILDING THE TANKS

PRODUCTION	
Male tanks:	701–775
Female tanks:	501–575

A good deal of research on thin armour plate had already been undertaken by the Royal Naval Air Service (RNAS) for its armoured cars, in conjunction with the William Beardmore Company of Glasgow. With the war at a crucial stage good-quality steel was in short supply and it proved equally difficult to find companies with spare production capacity. In the end this was only achieved by taking the steel from three firms which could each produce a certain amount. Two thicknesses were required: 10mm to cover vital areas and 6mm elsewhere. It was cut and drilled by the manufacturer in its soft state and then put through a hardening process that involved first heating the plate and then cooling it rapidly while pressing it flat. The variety of



View looking forward on the right side of a female tank. Notice the gunner's saddle on the right and the ammunition boxes in their racks. Near the top is a Pyrene extinguisher, left of that the clutch hand lever and the back of the driver's seat.

suppliers added to the logistic problem, since the plate had to be transported from Glasgow or Sheffield to Lincoln and Birmingham, while track links also came from Glasgow and the mechanical components from Coventry.

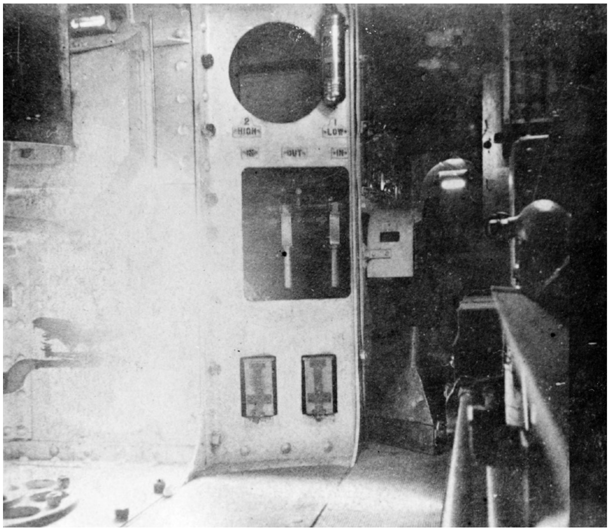
The basic shape of the tank was first assembled from angle-iron frames to which the armoured panels were then riveted or bolted as required. The engine and other internal fittings were lowered in from above and a set of 26 twin rollers inserted along the lower part of each frame. Ten of these rollers were fitted with sprung flanges intended to keep the tracks in line; skid rails carried the track over the top of the frames. A toothed idler wheel was installed at the front of the frame on each side and a similar toothed wheel at the back that meshed with the track links acted as the drive sprocket. Stretching of the track was countered by making the front sprockets adjustable to take up the slack. If this was not done regularly the tracks might come off, but even with this maintenance they were usually worn out after about 25 or 30 miles (and drive sprockets only lasted for about 20 miles).

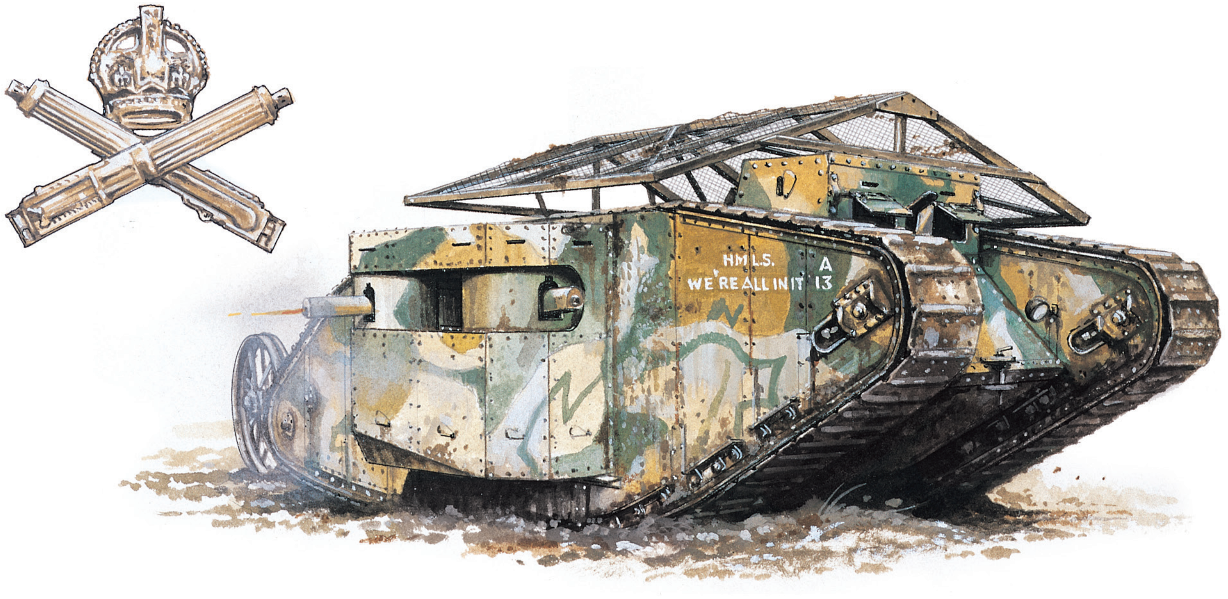
Viewed in profile, it will be noted that the track frames were not flat where they ran along the ground, but gently curved. This meant that on a hard surface no more than eight track links per side (from a total of 90 that comprised a complete loop) were in touch with the ground, so that the tank might turn easily. On soft ground, however, more links pressed into the surface, thus gradually reducing the overall ground pressure, but this made it increasingly difficult to turn, due to the lateral resistance of the soil.

The original War Office order for 100 tanks was divided so that Metropolitan was to build 75 machines with the balance coming from Lincoln, reflecting the relative capacity of the firms involved. Metropolitan set up their production line at one of their constituent companies, the Oldbury Railway Carriage and Wagon Company, and in April 1916 they received a further order for 50 tanks. The whole batch of 150 tanks would subsequently be classified Mark I when new models appeared. The increase in the order was in line with a War Office decision to raise six tank companies, each of which would have 25 tanks, but it quickly created another problem. There would now not be enough guns to equip them all, so it was agreed that 50 per cent would be armed with heavy machine guns instead.

The new sponson, intended to carry a pair of Vickers water-cooled machine guns, looked as if it had been designed in a hurry. Cumbersome in shape and size, it had to fit the same aperture as the 6-pdr sponson and give both guns an arc of fire sufficient to cover the entire side of the tank. As a result the access door could not be full height which meant that it was very difficult to enter with any dignity and virtually impossible to get

Looking backwards on the right side, the other saddle can just be seen in the glare from the open door. At the centre the two starboard auxiliary gear levers hang down, above them another Pyrene extinguisher alongside the gear lubrication tank.





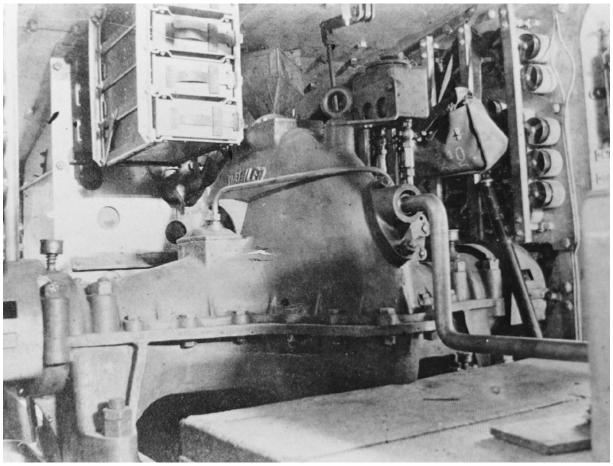
MARK I (FEMALE) TANK A11, HIS MAJESTY'S LANDSHIP *WE'RE ALL IN IT*, of A Company, Heavy Section, Machine Gun Corps; Somme area, France, November 1916

Basil Henriques claims that, soon after they arrived in France, crews were instructed to repaint their tanks in a more sober style. Surviving photographs suggest the result was by no means uniform, but a typical scheme appears to have involved alternating patches of green, brown and ochre, sometimes outlined in black to create a sort of crazy paving effect. This was more along the lines of a disruptive pattern to disguise the shape than with the aim of blending with the landscape. Each crew had a letter and number, indicating their place in the company organisation, and invariably also selected a name for their particular tank. These names sometimes followed a theme but were usually frivolous at this early stage, often taking the titles of popular London shows or a play on words such as *A Merry Car* and *Autogofasta*. Some tanks of C Company were named after drinks including *Cognac*, *Chablis* and *Crème de Menthe*, while D Company were more varied with *Daredevil*, *Dinnaken* or *Dracula*. At this stage Heavy Section personnel wore the cap badge of the Machine Gun Corps. (Art by Tony Bryan, © Osprey Publishing)

out of in a hurry, rendering the tank a death trap in an emergency. Once inside, the machine gunners sat on bicycle-type saddles, attached to the pillars that supported the guns. Each weapon was encased, around its barrel, in a protective armoured jacket so that an extended foresight had to be fitted to the gun where it protruded above the armour.

In order to distinguish between the two types, those tanks fitted with 6-pdr guns were designated male, while machine-gun tanks were known as female. This, of course, means that Mother was in fact a male. These first production tanks differed from Mother in many details, only a few of which need to be noted here. Additional springs were added to the tail assembly, presumably to increase ground pressure and give extra support during trench crossing. Perforations in the hull plates above the radiator were eliminated and baffles, in the shape of an inverted V, were located above the three exhaust outlets. The round lookout hatch on top of the hull was moved back to the next panel and, as already mentioned, rivet spacing reverted to girder-makers' pitch.

That this first design was crude goes without saying. It was inevitable under the circumstances, but it is a fact that has often been ignored when the failures of these first tanks are discussed. Even so there is one feature that might have been questioned from the outset – the location of the fuel tanks. For the sake of simplicity it was agreed that gravity feed should be employed and this naturally required the fuel to be located as high up in the vehicle as possible. This was achieved by fitting two 25-gallon tanks in the front of the hull frames, on either side of the cab. They must have been tiresome things to fill, since there was no external access, and if the tank went nose-down into a trench there was a fair chance that the petrol supply would be cut off. Worse still was the risk of fire, for if a fuel tank was hit in combat the interior would become an inferno in seconds. There would be no chance at all for the men at the front and precious little for any of the crew of a female machine, with its poor escape facilities.

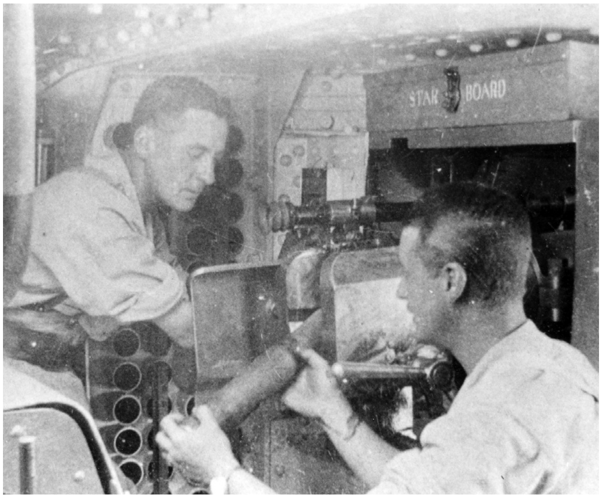


The huge Daimler differential dominates this view of a male tank. Ahead of it the starting handle, behind it the radiator. Notice how the 6-pdr rounds were held in place by wooden battens, and see also the rack for boxes of machine-gun ammunition.

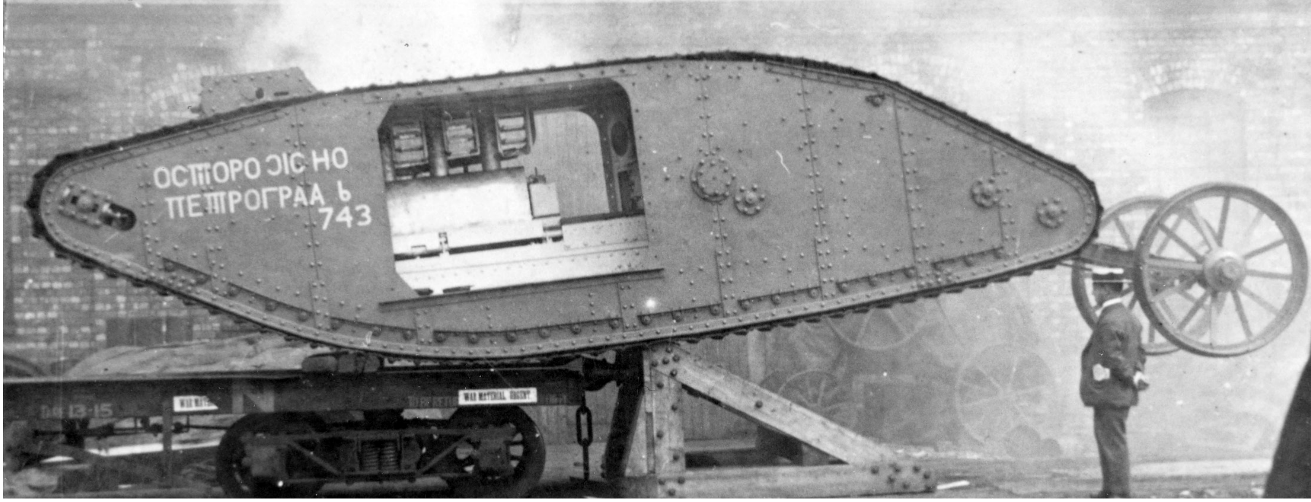
Although it was understood that the armour was only adequate to resist small-arms fire – and shell fragments to some extent – there was a fear that bundles of grenades, thrown onto the roof, might do severe damage. Trials revealed in June 1916 that a burster plate, spaced 12in from the top of the hull, would prevent damage. According to Metropolitan, 25 sets of 4mm thick perforated plate were manufactured, but never fitted, although some tanks were completed with extra studs to attach them. Later a gabled roof of wood and wire netting was designed, reportedly by Walter Wilson, and fitted to some C Company tanks when they went to France. That there was good reason for this was discovered when, later in the war, an old Mark I was tested against grenades. A bundle of five, detonated on the roof, would do substantial damage and might have injured the crew, and similar trials against the tracks revealed that, if they did not break, they would be damaged sufficiently to immobilise the tank.

CREW DUTIES

The basic mechanical functions have already been described, but the task of driving an early tank was very much a team effort. Up to four men were needed to start the engine, turning a crank handle located above the gearbox. Once it was firing the driver engaged first or second gear as ground conditions dictated and signalled the gearsmen to do likewise. Conditions inside the tank were appalling. Noise from the engine, within the confined space, was so loud that it was impossible to hear someone shouting, never mind normal speech, and before long the internal temperature could rise to 120 degrees Farenheit (50 degrees Celsius) or more. Worse still the engine was soon gushing clouds of carbon monoxide from its exhaust, which could render the crew temporarily ill and



Gunner and loader at the starboard sponson on a male tank. They have no seats but cannot stand upright. The loader offers up a round to the breech, alongside is a shield to protect the gunner and above that the sighting telescope.



Tank 743 climbs over a portable ramp, onto a railway wagon in Foster's yard. The sponsons have been removed, revealing the engine and exhaust stacks. Clouds of fumes swirl around the vehicle; whenever the engine was tilted, displaced engine oil was burned in this way.

mentally confused. Add to that fumes from the internal fuel tanks, guns, and sweating humanity, and it was all particularly unpleasant.

According to Colonel J.F.C. Fuller the steering tail was a nest of troubles. Besides being very hard work for the driver, the cable which ran from his steering wheel to the tail often stretched or came off the pulleys, and if that was not bad enough the hydraulic apparatus at the back was always giving trouble.

Aside from the tail wheels the crew had three ways of steering the tank. To 'steer slightly' as the *Tank Driver's Handbook* put it, the commander, sitting alongside the driver, applied the appropriate track brake. This slowed down one track while the other continued to run by differential effect. However, the strain was tremendous, both on the operator, struggling to fight the power of the engine, and the brake linings themselves which wore out rapidly, requiring continual adjustment. To swing the tank, that is to turn it through a considerable arc, the driver locked the differential and signalled the gearsmen to engage or disengage the secondary gears depending on the direction of the turn. With a brake applied to the disengaged track the tank would turn on the spot, pushed around by the driven track. This could only be done by first halting the tank, and once the manoeuvre was complete it had to stop again while the gears were reset. The third method, to induce the tank to 'turn quickly', was also described. This involved leaving the differential unlocked, engaging high ratio on one side and low on the other and, if need be, applying the track brake on the 'high' side. Thus the tank turned towards the high ratio side. Other sources claim that this practice damaged the secondary gear shafts, so it was generally discouraged. It would in any case require a great deal of manual dexterity and coordination to be effective.

The role of the secondary gearsmen was not limited to steering. Every 30 minutes or so they had to squirt thick grease over the gears and, when they were not doing that, keep an eye on the engine. During a fight they also passed ammunition forward.

In addition to the controls already mentioned the driver had a footbrake, which acted upon the main drive shaft, just behind the differential. If anything this worked too well and, if not used with care, could wreck the gears. In theory it was also possible to stop the tank by hauling back on both steering brakes, but in practice, at least on level ground, the tank would stop anyway, as soon as the clutch pedal was depressed.

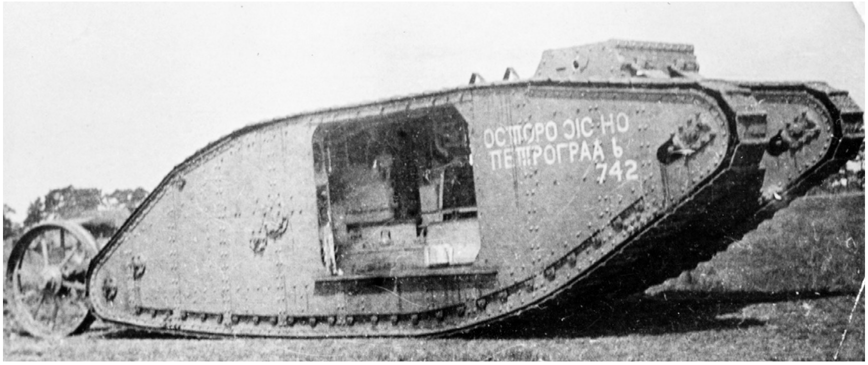
Drivers were enjoined to approach all obstacles square-on and keep moving. When tackling a steep slope the drill was to lock the differential to prevent either track from slipping during a climb and engage low gears when descending. The instructions were to drive as fast as possible over soft ground to prevent the tank from bellying, but since the top speed was only about 3mph this was a relative term. On firmer ground tree stumps and other hard obstacles were a threat. The ideal was to drive over them with the tracks and not let them get beneath the belly of the tank because, if they stuck, the lower hull plates would be forced up until they fouled the flywheel and brought the tank to a halt.

Turning now to the gunners; on a male tank their roles were obvious but not easy. For one thing both gunner and loader were unable to stand upright or sit down but had to bend over the gun. The gunner used his body weight to elevate or traverse the weapon while squinting through a crude telescopic sight. Firing the 6-pdr accurately on the move was completely impossible since vibrations from the unsprung tracks, transmitted through the body of the tank, caused the telescope to vibrate so that the gunner could not see anything. This was not a problem for the machine gunners in female tanks who were firing for effect most of the time anyway. The male tanks carried three Hotchkiss air-cooled machine guns; one in the front, operated by the commander or driver as needed, and one in each sponson, behind the main gun; these could be fired by the loader or gearsman. The loader, of course, also had to dispose of empty 6-pdr shell cases, which was done by dropping them through a narrow opening at the base of the sponson door.

A male tank carried 334 rounds of 6-pdr ammunition in various locations around the tank. The ammunition available at the outset was a gunpowder-filled, common pointed projectile with a base percussion fuse. The female tanks carried 24,320 rounds of Vickers .303in ammunition packed in 76 boxes containing 320 rounds each.

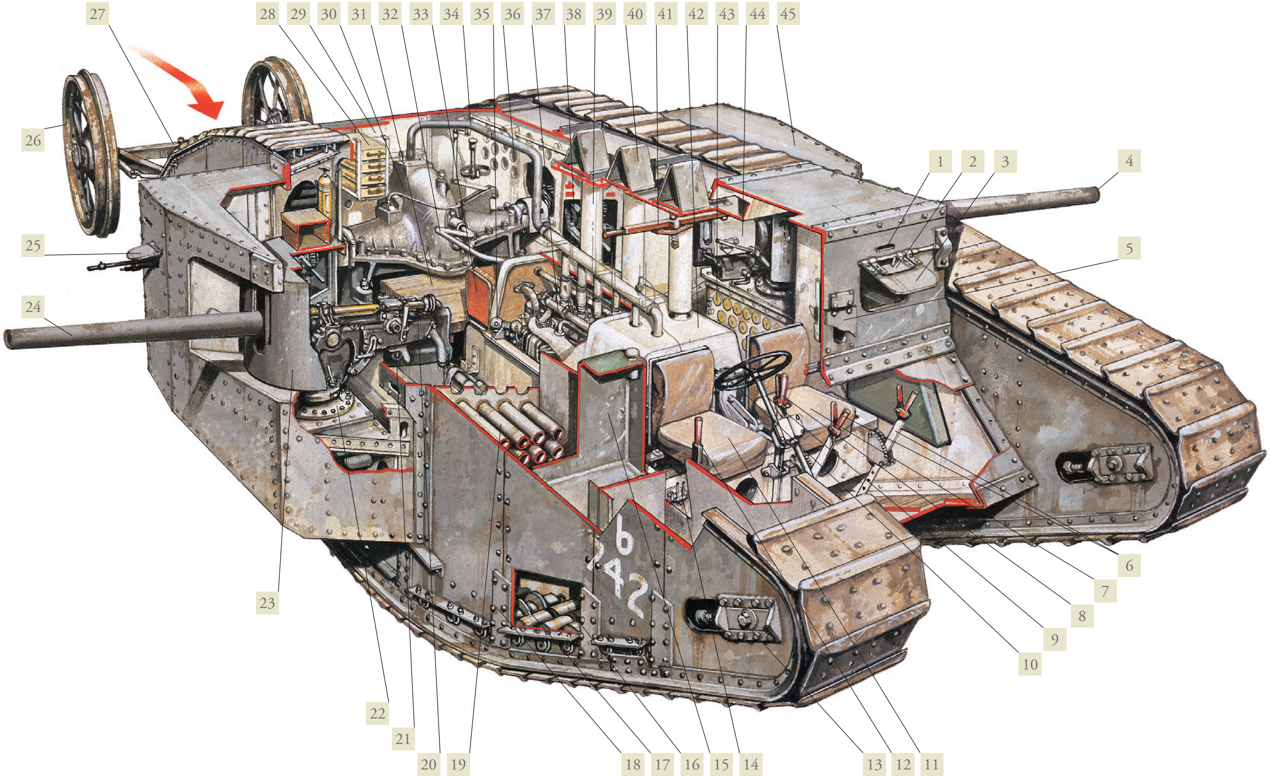
Shortly before the tanks went to France the War Office asked the Admiralty Compass Department to advise on the matter of compasses in tanks. They decided upon a boat compass, the sort of thing that is carried in ship's boats. The compass had to be carefully adjusted to counter the deviating effect of a dense mass of metal. Even so, according to some sources, the compass deviated every time the driver moved the gear lever and one wonders how it stood up to the continual vibration.

Finding room for all the other items needed when a tank went into action provided another challenge. Captain Basil Henriques, who commanded the female tank C22 during the first tank action, said that, in addition to iron rations his crew carried 16 loaves of bread and 30 tins of food, along with cheese, tea, sugar and milk. That may have satisfied the crew, but what about the tank? To keep the machinery going the crew needed a spare drum of engine oil, another of gear oil, two small drums of grease and three cans of water. On top of that they had to find room for a first-aid kit, two boxes of revolver ammunition, a spare Vickers machine gun and four spare barrels for the Vickers and one for a Hotchkiss, two wire cutters and three signalling flags which, according to Henriques, they could never find when they needed them.



During initial training at Thetford tanks invariably ran without their sponsons, which some felt was foolish. Notice the vision slit and open pistol port on the side of the cab. It is also clear that 742 has been losing a lot of engine oil.

MARK I (MALE) TANK, NO. 742, in original condition (tank D7 of No. 2 Section, D Company, Heavy Section Machine Gun Corps commanded by Lieutenant A. J. Enoch at Flers, 15 September 1916)



Key

1 Commander's vision slit
2 Commander's small visor flap
3 Commander's main visor flap
4 Port side 6-pdr gun
5 Front machine-gun aperture
6 Steering brake levers
7 Commander's seat
8 Primary gear lever
9 Steering wheel (for tail)
10 Starter chain sprocket
11 Driver's seat
12 Clutch hand lever
13 Track tension adjuster
14 Engine controls
15 Starboard petrol tank
16 Track roller, smooth type
17 Track roller, flanged type
18 External butt strap
19 Ammunition stowage tubes
20 Gunner's sighting telescope
21 Trigger mechanism
22 Main armament pedestal
23 Rotating gun shield
24 Starboard 6-pdr gun barrel
25 Sponson machine-gun position
26 Steering tail wheel
27 Tail frame
28 Machine-gun ammunition stowage
29 Radiator
30 Differential driving axle
31 Primary gearbox cover
32 Engine starting handle
33 Engine oil tank
34 Return coolant pipe
35 Engine governor
36 Reserve ammunition stowage
37 Daimler 105hp engine
38 Secondary gearbox, port side
39 Engine exhaust stack
40 Exhaust outlet baffle
41 Differential locking lever
42 Engine cover
43 Ready-use ammunition stowage
44 Port 6-pdr breech assembly
45 Port side sponson roof

The interior of each tank was painted white, in an effort to improve visibility for the crew, although the floor was covered in black rubber matting. Parts of the engine were in a natural metal finish. Each tank received a number (listed in the text) when it was complete, which remained with it until the end, although often obscured by the camouflage. As a security measure, tanks also bore the legend 'Handle With Care! – Petrograd' in Cyrillic letters on each side of the hull, sometimes behind the sponsons, sometimes in front. This could be seen on tanks in France, suggesting that not all of them were camouflaged. The tank's number, on a cast plate, was also displayed at the secondary gear position. (Art by Tony Bryan, © Osprey Publishing)

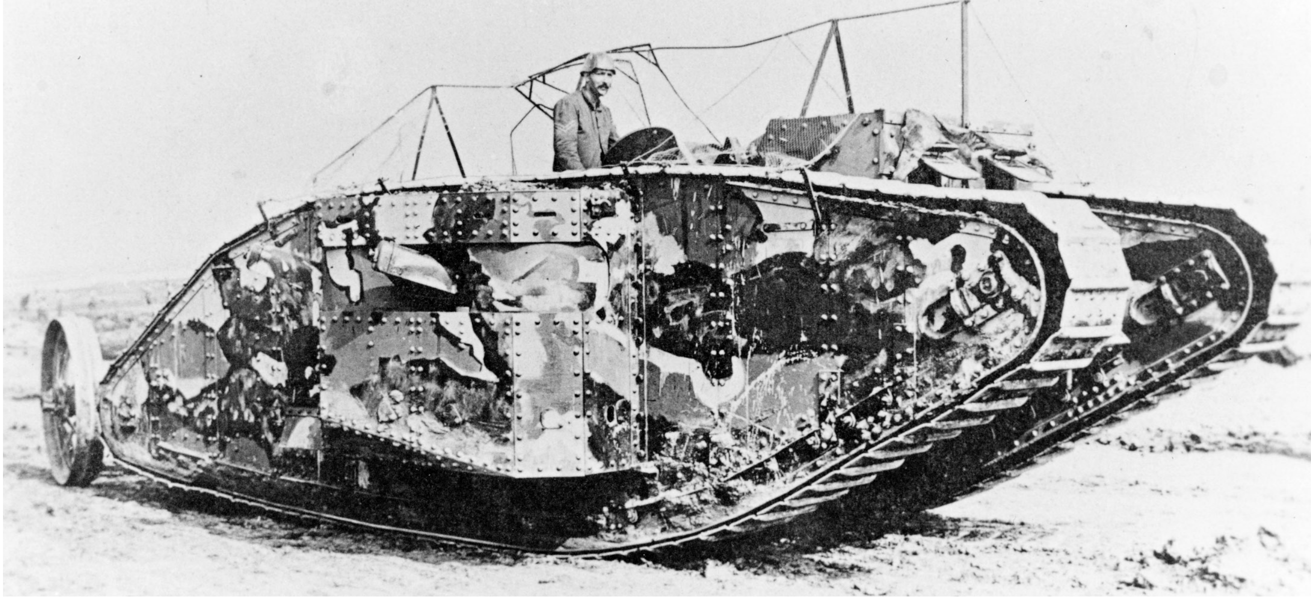
Specifications

Crew: eight
Weight: 28 tons
Power to weight ratio: 3.7bhp/ton
Overall length including tail assembly: 32ft 6in
Overall width: 13ft 8in
Overall height: 7ft 11in
Engine: Daimler/Knight sleeve valve, water-cooled straight-six 105hp @ 1,000rpm
Transmission: two-speed and reverse primary box with secondary two-speed selectors on the output shafts
Fuel capacity: 49 gallons
Max speed: 3mph
Radius of action: 23 miles
Fuel consumption: 2.1 gallons per mile
Trench crossing capability: 11ft 5in
Armament: Two 6-pdr (57mm) 40-calibre, quick-firing, and four 7.62mm Hotchkiss air-cooled machine guns
Ammunition: solid shot and high explosive
Muzzle velocity: 1,818ft/sec
Max range: 22,500ft
Ammunition stowage: 332 rounds of 6-pdr, 6,272 of MG

Many tanks had a wooden box made to fit on the tail frame, in which they carried extra cans of petrol. In his book *Sagittarius Rising* Cecil Lewis, who was flying observation patrols with No. 3 Squadron, Royal Flying Corps, on the day tanks attacked for the first time, mentions seeing tanks refuelling in the village street of Flers 'the red petrol tins visible on their brown backs'. Another commander claims that each tank carried a coil of wire cable on the back, equipped with hooks, which could be used to tow other tanks out of trouble.

Each crew member was issued with two gas helmets, one pair of goggles and a leather helmet to shield his head from contact with the hull, in addition to his water bottle, field service cap and haversack, all of which had to be put somewhere. The tank crew's personal weapons were revolvers, which could be fired through a selection of protected loopholes located all around the tank. This was necessary to discourage mass attacks by enemy infantry who, if they could get aboard the machine, would strive in every way possible to get at the crew. There was even a pistol loophole in the lower sloping plate at the front so that the driver or commander could shoot downwards as the tank nosed over a trench. Some tanks carried a ninth man who was wedged at the back, alongside the radiator, to shoot through a loophole in the tiny rear door at anyone foolhardy enough to think they might climb up over the tail.

With all openings closed, the crew relied on a few tiny festoon lamps to illuminate the interior. As built, the tanks also had headlights and a small, red tail-light, but these lasted hardly any time in action. Looking out from within the tank was equally difficult. The driver and commander had slim periscopes that projected through the roof of the cab and large, hinged flaps in front of them which opened in two stages, first to reveal a narrow slot and then a large opening for driving when out of action. There were also permanent slits in the front and sides of the cab and in various locations on the sponsons. These were covered on the inside by castings which held glass prisms, but these did not allow very good visibility and invariably shattered under fire. In addition to the signal flags mentioned by Henriques, some tanks carried a pair of carrier pigeons in a basket, a signalling lamp and a telephone handset with 100 yards (about 90m) of telephone cable. The optimistic theory behind this last item was that the tank would leave a second handset at its starting point and reel



This well-known photograph is now believed to have been taken at Thetford. It shows a female tank finished in Solomon's exotic camouflage. The net on top may be an early experimental wireless aerial and the NCO is wearing a leather tank helmet.

out the cable as it went. Since the tanks were expected to travel more than 100 yards this notion was soon abandoned.

TRAINING FOR WAR

The first tanks were ready to leave the factories in Birmingham and Lincoln by the middle of June 1916. A special training ground, isolated from the public gaze, had been established on a large shooting estate near Thetford in Norfolk and it was here that men newly recruited to the Heavy Section, Machine Gun Corps, first encountered them. To begin with they only had Mother, now shorn of her guns, and progress was slow, but as more tanks arrived it speeded up.

The tanks had to travel by rail and, since they were too wide to clear the loading gauge, they had their sponsons removed for transportation. This was a difficult and time-consuming process that involved fitting trestles to the roof of each tank, from which chain hoists were slung to take the weight as the sponsons were unbolted. Special four-wheeled trailers were built to carry the sponsons, but there is evidence to suggest that the tanks used for driver training at Thetford ran without their sponsons for most of the time. Certainly one newly joined officer criticized this, arguing that without sponsons fitted the crews did not get a realistic experience of conditions inside a tank. For one thing a pair of sponsons weighed in the region of 3½ tons and their absence made a considerable difference to how the tank behaved. Also, of course, with the sponsons removed ventilation was vastly improved and, insofar as it affected manoeuvring, the driver had no need to account for the additional width of a complete tank.

Training at Thetford was restricted to mechanical matters, driving and maintenance. For basic gunnery training on the 6-pdr troops went to the Royal Navy's gunnery school, HMS *Excellent* on Whale Island in Portsmouth Harbour. The greatest difficulty was in finding a means to train the men in the far more difficult task of firing the guns from the tanks themselves.

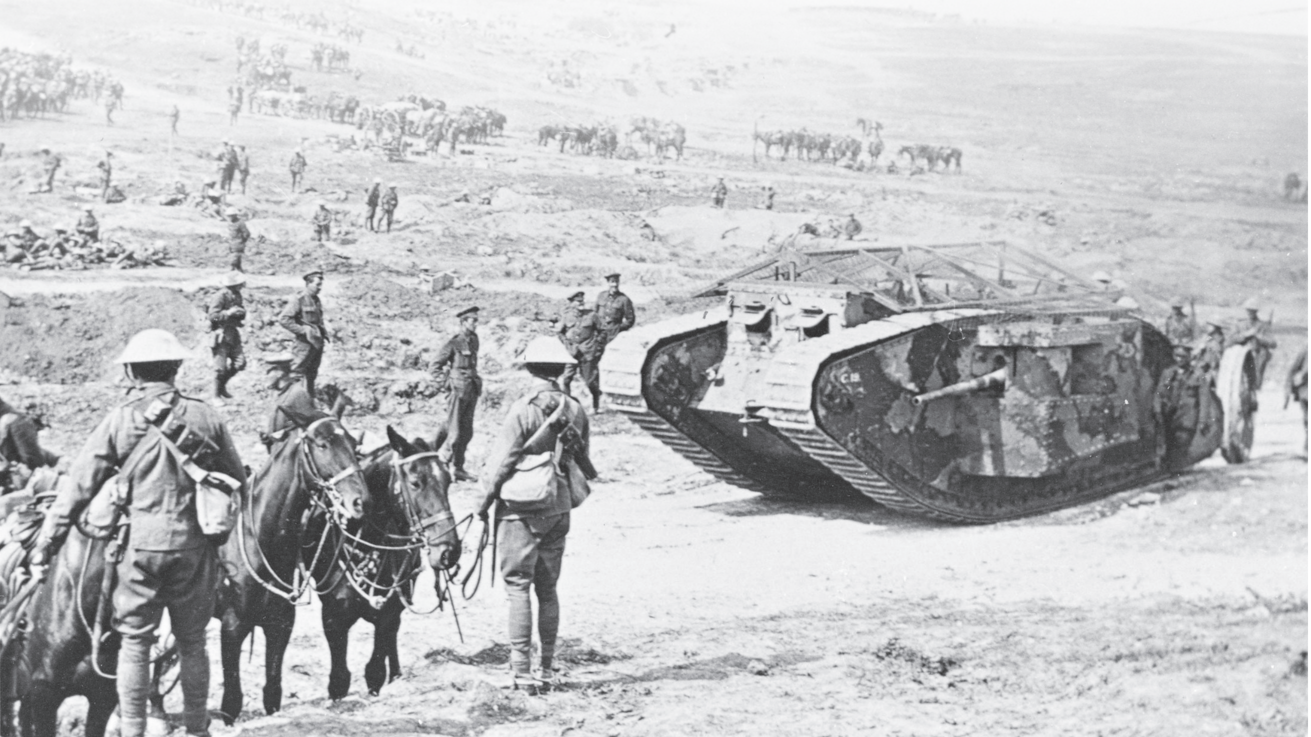
Various factors conspired to delay production, but once it got into its stride tanks were being manufactured at the rate of about 25 per week. Shipments to France began on 13 August 1916 when 13 tanks of C Company left Thetford by rail for Avonmouth docks and thence by ship to Le Havre. From there, again by rail, they were moved to a site near Abbeville for a period of training and familiarization with the troops who would later accompany them into action. The next move took them to a railhead known as The Loop, near Bray-sur-Somme where they would be prepared for action. Under pressure from General Headquarters in France the tanks were required for a battle due to begin in mid-September.

THE FIRST TANK BATTLES

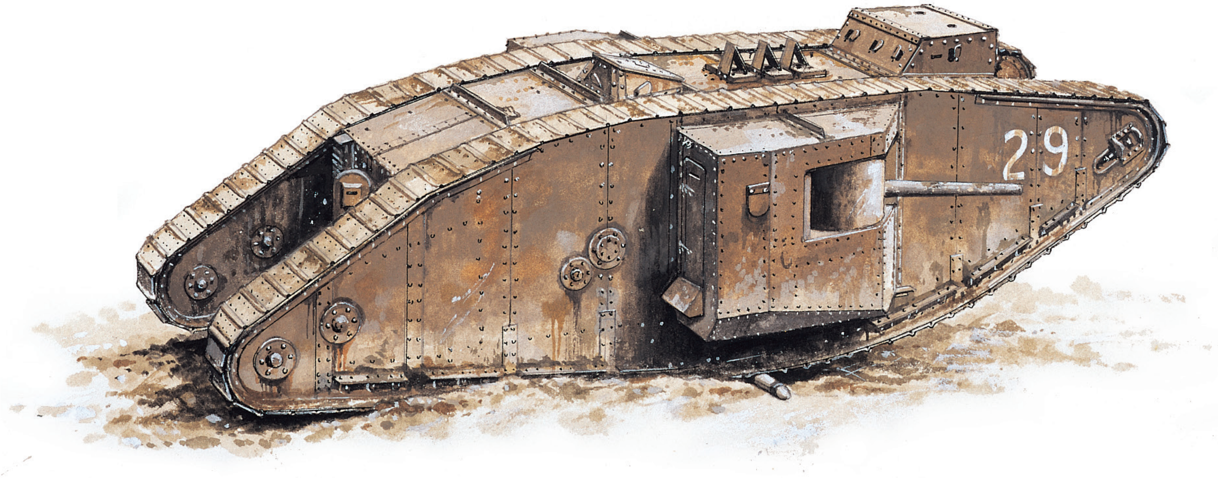
The organization favoured by the War Office was for each company to consist of four sections, each of six tanks (ideally three male and three female) plus one tank per company as a spare. In all there were some 60 tanks in France at this time. Twenty-five had been issued to each of the two companies (C and D) of the Heavy Section, Machine Gun Corps; a further ten were retained in reserve, although some immediately replaced a few that had broken down during training and could not be repaired for want of spare parts.

The battle plan reflected an understandable lack of experience or even comprehension of what these new weapons were supposed to do. Prevailing logic suggested that they should be employed against identified strongpoints in the German line to which end special lanes were left open through the British barrage, along which they would advance. The scheme was nearly wrecked by overconfidence. Demonstrations laid on before the battle seemed to suggest that there was little the tanks could not do. In practice, as they struggled up to the start line in the dark, some lost their way and most became entangled with other traffic so that, by the time they arrived, the crews were exhausted and fuel reserves low. Since many of these men had no previous experience of war, and most notably of the horrific conditions of the Western Front, everything must have been bewildering.

The first tank battle, known as Flers-Courcelette after two villages that were objectives for the attack, was part of the 1916 Somme campaign and it was scheduled to start at 6.20am on 15 September 1916. In fact it began about one hour earlier when male tank No. 765, crew D1, under Captain H.W. Mortimore started to move. In theory this



Everyone stops to watch as C19 *Clan Leslie* makes its way along Chimpanzee Valley en route to the front. The camouflage is particularly striking and includes the gun barrels. The driver appears to be using the tail wheels to bring the tank's nose round a few degrees.



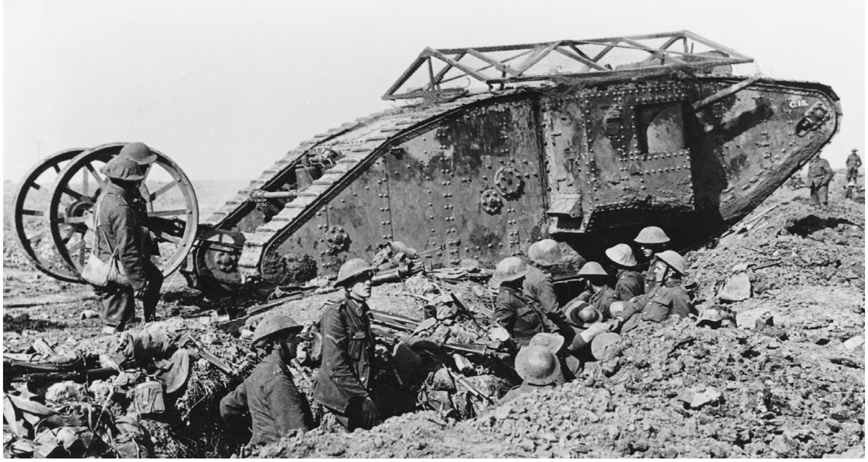
MARK III (MALE) TRAINING TANK, Bovington Camp, Dorset, 1917

The training tanks sometimes operated without guns, which were in short supply. Bovington appears to have introduced a system of training numbers, which bore no relation at all to the tank's own number. These were painted in white, on each side of the hull ahead of the sponsons, and were quite large. The earliest examples were two digits, later three.

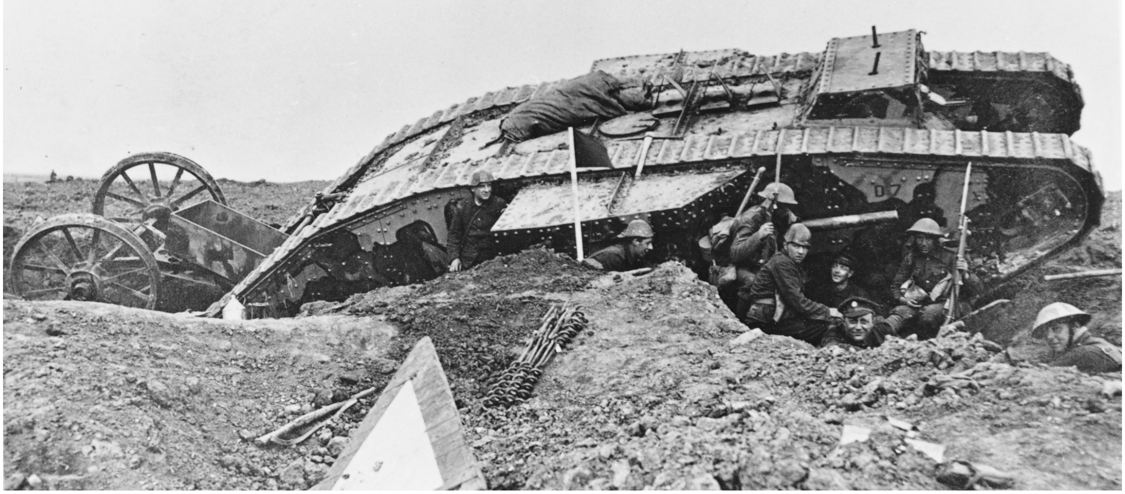
The first people to undergo training were the instructors, who then passed on their skills to new tank crews. Training involved basic driving and maintenance and then graduated to tactical exercises on a network of trenches on the Bovington ranges. For officers there were extra courses in compass and map reading along with the technique of using white tape to set out approach routes. Drivers received extensive training in trench crossing and in extracting their tanks if they got stuck. Much of this involved hard work with a spade, although a number of special devices were tested to assist this process. One such was the torpedo spud, a short piece of rounded wood, attached to the track by collar and chain to provide purchase. (Art by Tony Bryan, © Osprey Publishing)

should have been one of three tanks, but the other two were delayed. This situation was repeated all along the front since just 32 tanks, out of 49 originally available, were ready to start on the day. Of these, five were soon ditched in trenches or shell holes, nine broke down, nine more were too slow to keep up, but did some useful work mopping up, and the final nine led the way, got well into the enemy lines and caused considerable damage.

In the thick of it more problems were encountered. Both Basil Henriques and Lieutenant Vic Huffam, who was in action the following day with D9, reported that



Another classic photograph: C15 moving up for the attack on Thiepval on 26 September 1916. Mud is thickly plastered at the front and seems to have obliterated much of the camouflage. The tank is running with its tail clear of the ground, the gun on full elevation and doors shut.



D7 ditched. Notice the two periscopes sticking out of the cab roof, the top hatch, the front Hotchkiss machine gun still in place and the camouflage box on the tail. D Company had to manage without anti-grenade roofs on their tanks, but note two crew members are wearing their leather helmets.

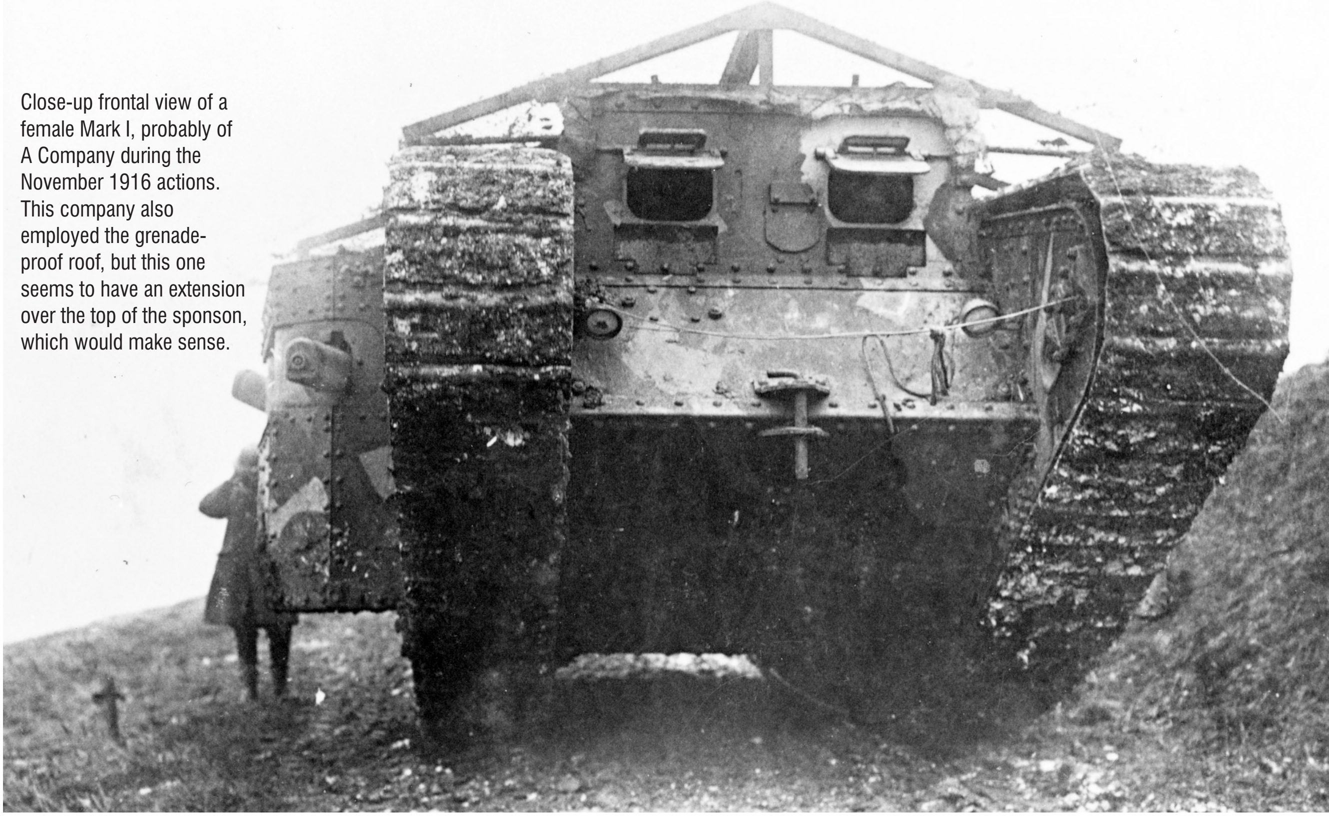
enemy machine-gun bullets came through the armour and killed or wounded members of the crew – it may be relevant that both tanks were females. They also agreed that bullets striking glass prisms in the vision blocks shattered them, sending splinters into the driver's eyes. One tank (C5 *Crème-de-Menthe*) lost one of its tail wheels, but it is a measure of contemporary inexperience that, when another tank had its entire tail assembly blown off, the commander believed his tank to be incapacitated.

The lack of a silencer for the exhaust system proved to be another problem. Great clouds of fumes belched out as the tank tipped in and out of shell holes and, after dark, sparks could often be seen spiralling up around the baffles, but worst of all was the noise. Crews improvised, making rudimentary silencers from old oil drums or packing mud around the baffles, or even wet sacks.

Three tanks were in action on the following day (16 September). They managed to stem a German counterattack near Flers, but they were all hit and put out of action. Indeed Huffam, in D9, recalled seeing Court's tank smothered in shellfire, and it appears to have exploded with the loss of the entire crew. On the whole, however, casualties among the tank crews were light and many of the tanks abandoned on the 15th were subsequently recovered. Those that were not appear to have remained on the battlefield until the very end of the war when some were photographed lying derelict or being broken up for scrap by German prisoners-of-war.

Thus this first attempt at tank warfare can only be regarded as a limited success at best, yet it had a remarkable effect and in a most improbable quarter. Four days after that first battle the British Commander-in-Chief in France, Sir Douglas Haig, sent a representative to London with an order for 1,000 more tanks.

A dozen tanks were available for action on 25 September, eight of which were not actually used because the infantry proved capable of undertaking the task without them. Of the other four, two did some minor work and the last pair did not get called into action until it was too late. However, the infantry they were scheduled to help came up against a grim German position known as the Gird Trench near Gueudecourt. One of these tanks was damaged by artillery fire so, on the following day a single tank, commanded by 2nd Lieutenant Storey, took on the Gird Trench by itself. The result was so impressive that some 300 German prisoners were captured and Storey was awarded the Distinguished Service Order for 'gallantry and initiative'. Haig himself noted on the citation: 'I consider this to be the best tank performance up to date.'

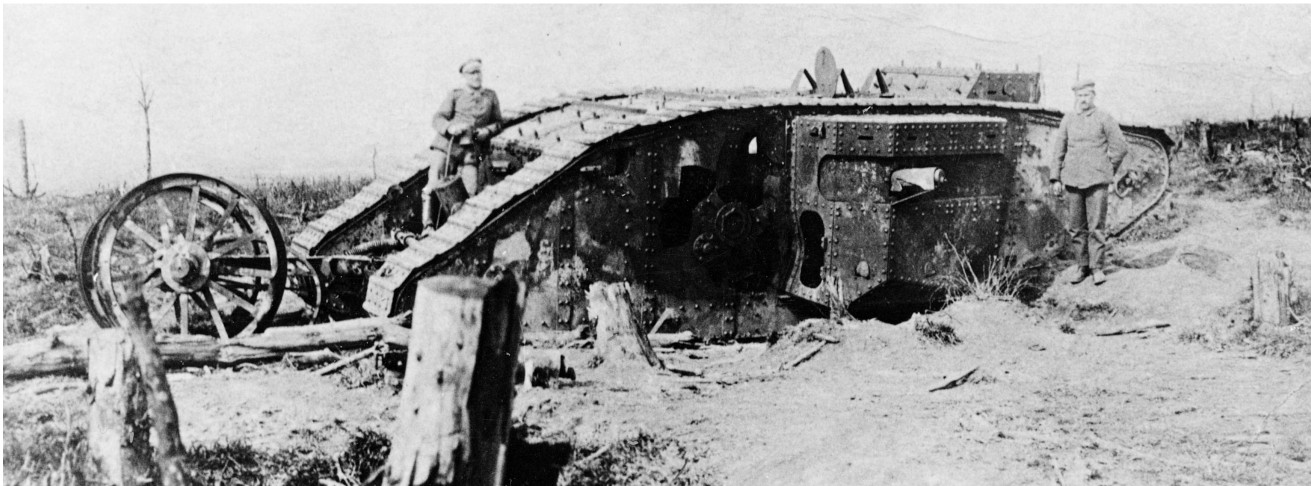


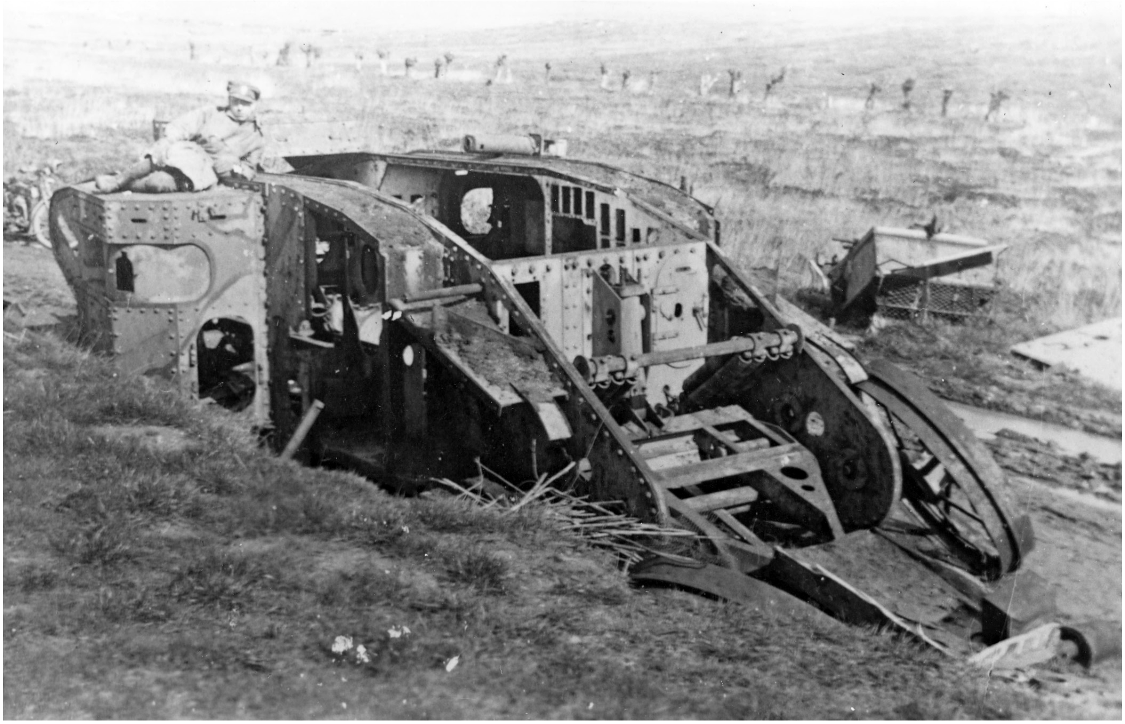
Close-up frontal view of a female Mark I, probably of A Company during the November 1916 actions. This company also employed the grenade-proof roof, but this one seems to have an extension over the top of the sponson, which would make sense.

At the end of September command of the tanks in France was given to Lieutenant-Colonel Hugh Elles, Royal Engineers, who retained this post right through to the end of the war. Tanks were used in small numbers throughout October, but weather conditions deteriorated and there were few successes. Even so the tanks were here to stay, a fact signified by a War Office announcement on 20 October that the force was to be enlarged and companies expanded to form battalions.

In reviewing these early actions some general comments can be made. In the first place it was immediately clear that the steering tail wheels were a complete waste of time. Some were lost in action and the affected tanks performed just as well without them, although trench-crossing ability was reduced to some extent. The sponsons were also regarded as too large. The male type tended to dig into the ground, bringing the machine to a halt, while the female pattern was a very poor design, badly made, which tended to let bullets through. The 'grenade-proof' roof was equally troublesome and the elaborate camouflage schemes were soon obliterated by mud running down

German troops with the abandoned hulk of D13 *Delilah*. This tank appears to have redundant studs for the burster plates on the upper panels. The tiny access door in the female sponson has been blown off, but one can appreciate how small the opening is.





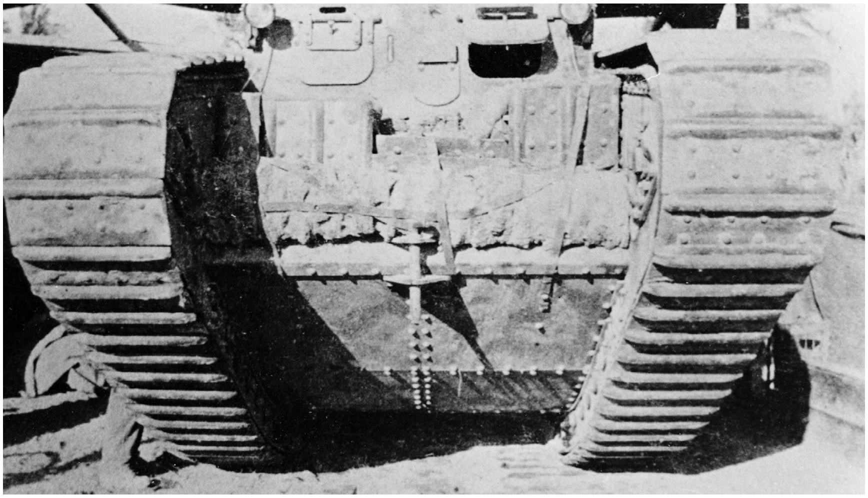
The wreck of D11, photographed much later in the war. Points to note are the vision slits around the top of the sponson, the tail frame with its wooden box, internal stowage for machine-gun ammunition and the spindle for the single top roller. The track skid rails that run along the tops of the frames have been obscured by mud.

from the tracks. Mud also found its way inside, and clogged up the final drive so much so that, according to B Company, it was impossible to operate in top gear.

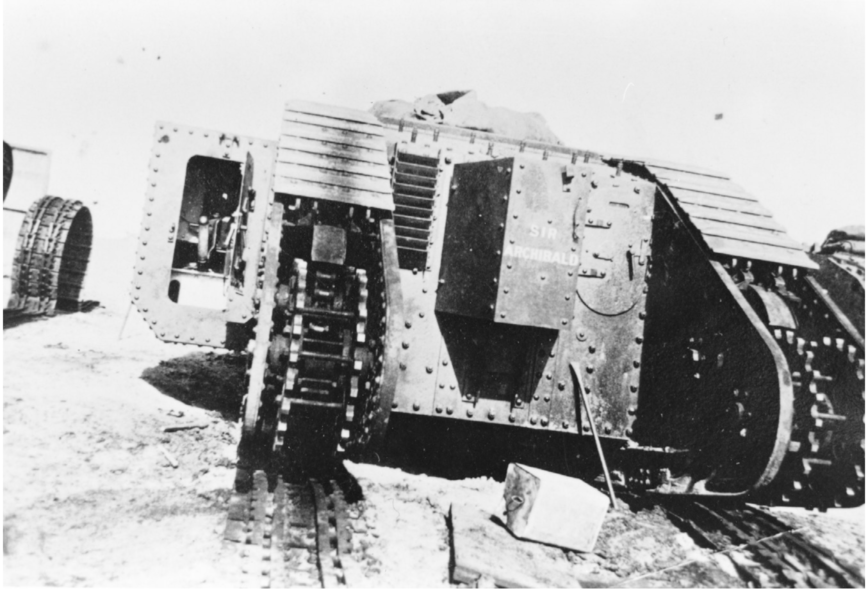
Reliability was clearly a key factor. Much was due to poor workmanship, which Wilson had already complained about, but also to the inexperience of crews who were not yet skilled enough to select the best ground or to anticipate mechanical failures in time to put them right. For the long term there was also criticism of the amount of track adjustment, the width of the tracks themselves and, inevitably, the location of the fuel tanks. These and many other matters of detail were corrected on female tank No. 555 which became an experimental test rig for the next model. The modifications included a narrower cab to accommodate wider tracks and a single enlarged fuel tank at the rear, in the space formerly occupied by the tail wheel frame.

For the immediate future the main problem was a desperate shortage of tanks. A Company, which had been in France since 14 September, had its baptism of fire on 13 and 14 November. On each occasion it was the action of an individual tank that won the day. Female tank 544, commanded by Lieutenant H.W. Hitchcock, was the only one of three tanks to get into action on the 13th and it was soon bogged in a shell hole while Hitchcock was wounded. The original plan was to abandon the tank, which was already surrounded by German infantry, but when Hitchcock was hit again, and two other men wounded, second-in-command Corporal Taffs took over. Assisted by Lance-Corporal Bevan, Taffs now got the tank restarted, reversed out of the hole and set a new course for his objective. Arriving at the German second line, the tank broke through the roof of a dugout and ended up, partly on its side and incapable of moving further. Unable to use his machine guns effectively with the tank at such an angle and attacked by the Germans with machine guns and grenades from all sides, Taffs managed to send off a pigeon, as a result of which, about an hour later, the trapped men were rescued by the infantry; all surviving members of the crew were awarded the Military Medal.

Right Spare track plates and what looks like part of a palm tree have been used to beef up the frontal protection of this Mark I in Palestine, so the headlamps have been relocated. The spikes just visible at the top appear to have been used to hold additional stores in place.

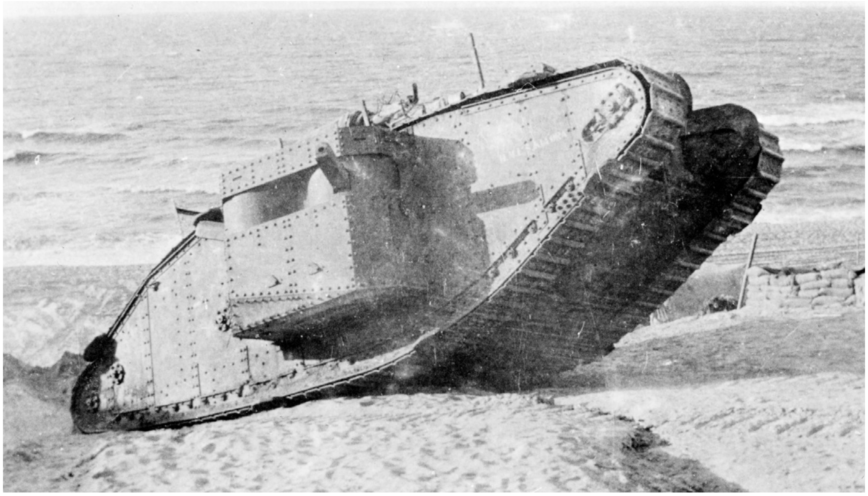


Below A marvellous rear view of *Sir Archibald* in Palestine showing the drive sprockets and a view in through the sponson door. None of the tanks in Palestine had tails, but in this case the shield that covered the hydraulic jack has been retained for some reason.



On the 14th success was only achieved by the incredible courage of the Heavy Branch Intelligence Officer, Captain Frederick Hotblack, who guided a tank into action over dreadful ground, under fire, by walking all the way to the objective in front of it. If these remarkable actions prove nothing else they show how quickly the tank men gained a pride in their new arm and the courage that went with it. Even so the stock of serviceable tanks from the first batch had now virtually run out. B Company, which also came out in September, had no tanks at all until a few surviving Mark Is were made available for training in January 1917.

The new tank order from Haig posed two immediate problems. It meant a considerable expansion of what had now become the Heavy Branch, Machine Gun Corps, and more tanks would be needed on which to train the new crews. It was also clear that more space would be required for men and tanks to train. This last problem was solved by opening up a large camp north of Wool in Dorset, centred upon Bovington Farm. At the same time 100 extra tanks were ordered for training.



HMLS *Kia-Ora*, one of Nutt's female tanks. Notice the use of track extenders, the extra panels inside the front horns (presumably to prevent sand being blown back into the cab) and the upright posts on top to keep stores in place.

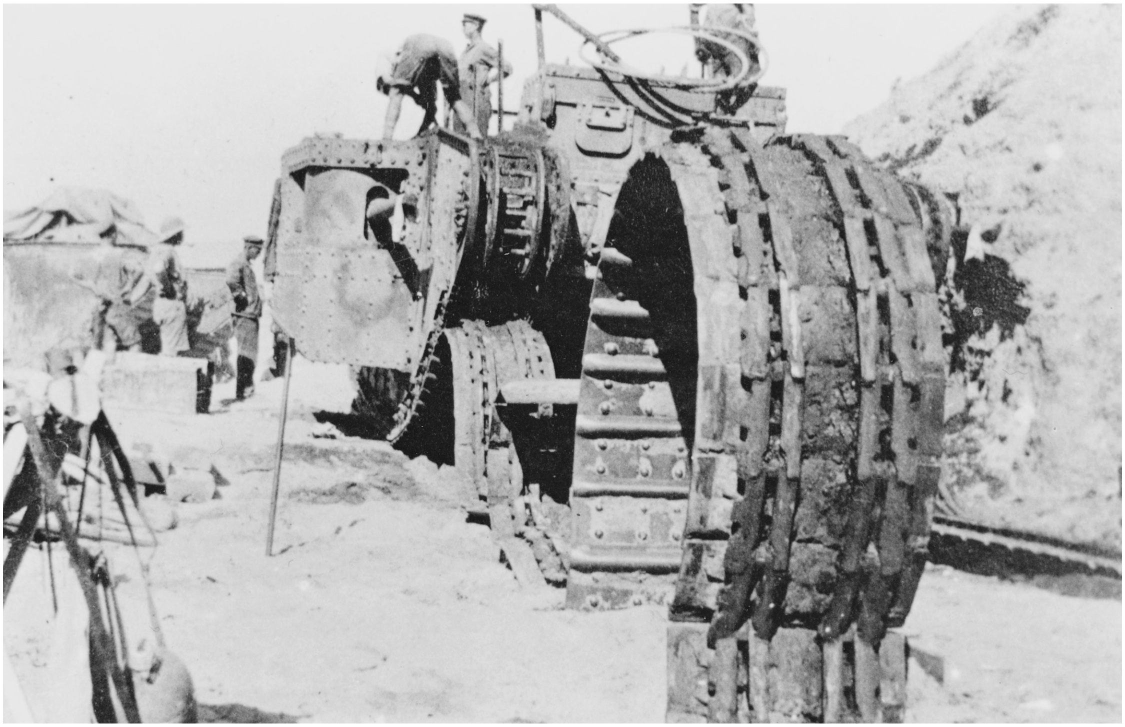
TANKS AT GAZA

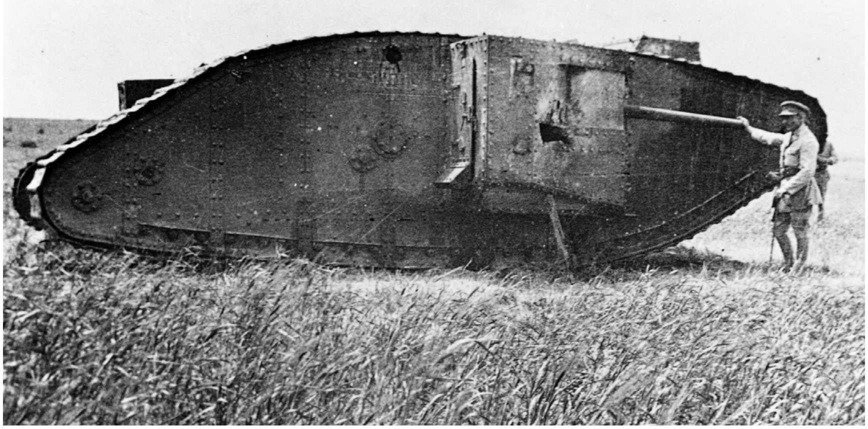
In January 1917 eight tanks from Bovington were shipped out to the Middle East to join the Egyptian Expeditionary Force which was intending to move north into Palestine against the Turks. The tanks arrived in Egypt and followed the army which, by March, was attempting to attack Turkish positions around the ancient city of Gaza. When the battle was resumed in April some of the tanks took part, but with only modest success; a number were wrecked. Inevitably senior officers in the area assumed that they knew much more about how tanks should be used than any of the young officers that served with them and, as a consequence, misused them. The tanks worked in pairs, widely separated, and suffered accordingly. Much to many people's surprise the Turks did not always flee when tanks appeared but took them on with artillery with inevitable results.

This tiny detachment, commanded by Major Norman Nutt, was a model of self-sufficiency and it was also innovative, which is often the case in such circumstances. Individual tanks were modified in a variety of ways to improve protection, either using palm logs or spare track links, or with the means to carry more stores on the tanks. This was done by adding upright pieces of angle iron to the top, which formed a kind of basket for the stores. Unfortunately these loose items moved about as the tank tackled obstacles and sometimes things would fall across the exhaust outlets and catch fire. Sand got in everywhere, just like the mud in France, but the abrasive effect was much more damaging. At least one tank was photographed with improvised shields of light steel on either side of the cab, obviously intended to deflect the stuff away from vital areas.

In Britain tanks went back to the factories for modification before being delivered to Bovington, where an intensive training programme was soon in full swing. Meanwhile the Heavy Branch had established a Central Workshop in France to prepare new machines for active service and maintain old ones. In November 1916 a number of modifications were introduced. Stronger rollers and improved brakes had already been recommended, but Central Workshops also went to the length of fitting smooth idler wheels at the front. The old toothed pattern had proved troublesome when the tracks stretched and this modification solved the difficulty.

Those tanks that had survived the 1916 actions were being refurbished for the 1917 campaigning season, but it was confidently expected that the new model would be



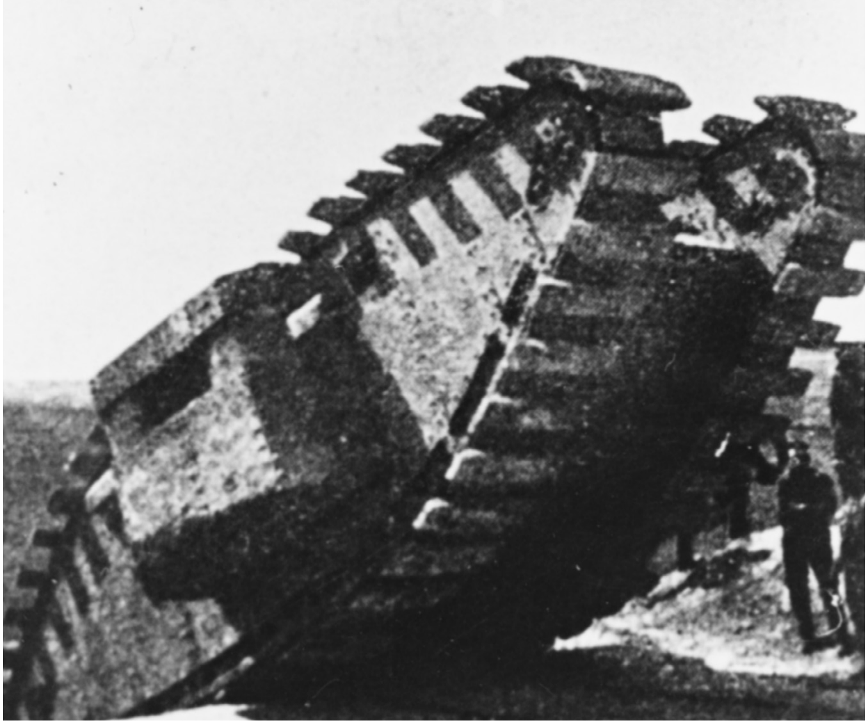


Above This front view of a Mark I undergoing maintenance in Palestine provides an excellent view of the idlers and track details. Notice that where the track joins the frames the inner flanges still hold it in place.

Right His Majesty's Land Ship *Pincher* serving with Major Nutt's detachment from E Battalion at Gaza. Keeping these old tanks running in a hostile climate, with few spares and inadequate workshop facilities, was a magnificent achievement by any standards.

available in time. In the event, when the battle of Arras began on 8 April 1917, only 15 of the original tanks were fit for action. They had to be supplemented by 19 training machines already in France and 26 more from home to complete C and D Battalions which now formed 1st Tank Brigade (the original companies expanded into battalions in January 1917 to make up new tank brigades of two battalions each).

Expansion of the force meant a new organization. The original plan would have created battalions with 72 tanks each; that is composed of three companies, each company comprising a headquarters section of four tanks and four fighting sections with five tanks each. However, this scheme was never implemented, and instead each company in the battalion had three fighting sections, of four tanks each and a reserve section; two battalions formed a brigade. None of which made any immediate difference since one company still had no tanks at all.



A poor but rare photograph of a female tank, fitted with special climbing spuds, tackling a mock sea wall during training for Operation *Hush*. This climb must have been a driver's nightmare. Had the operation gone ahead Mark IV tanks would have been employed.

In the Middle East the five surviving tanks, supplemented by some Mark IV machines to bring the total back up to eight, took part in the third battle of Gaza in early November 1917. It was ultimately successful, although each tank involved had up to five different tasks to perform as its part in the battle. Only one tank proved capable of fulfilling them all but the remainder did well enough. There was much greater incidence of track shedding than was known in France. Major Nutt put this down to a build-up of mixed grease and sand, which clogged up the sprockets and threw the track off. Nutt suggested that it might be better to run the tanks without grease but he said that, in that case, the drive sprockets would be better fitted with rollers instead of fixed teeth. In practice it did not matter since tanks were never called upon again in this campaign.

CONVERSIONS AND EXPERIMENTS

With the appearance of later models, the first 150 tanks were designated Mark I, and they still had their uses. For the battle of Messines, which began on 7 June 1917, 12 Mark I and Mark II male tanks served as supply carriers, having been converted by Central Workshops. The work involved stripping out the guns and their mountings, blanking off the aperture in each sponson and creating extra stowage trays on top. In action the supply tanks went forward in the wake of the fighting tanks to distribute extra ammunition, fuel and grease to tanks that might otherwise have to pull out of action to resupply. A few females were fitted out as wireless tanks with Morse key sets installed in one sponson and a substantial aerial array rigged on top. The wireless sets were a semi-portable type which had already been employed in the trenches, but they could only be used when the tank halted, turned off its engine and set up the aerial. Thus the idea was that they would stop at strategic locations to act as reporting stations in touch with headquarters.

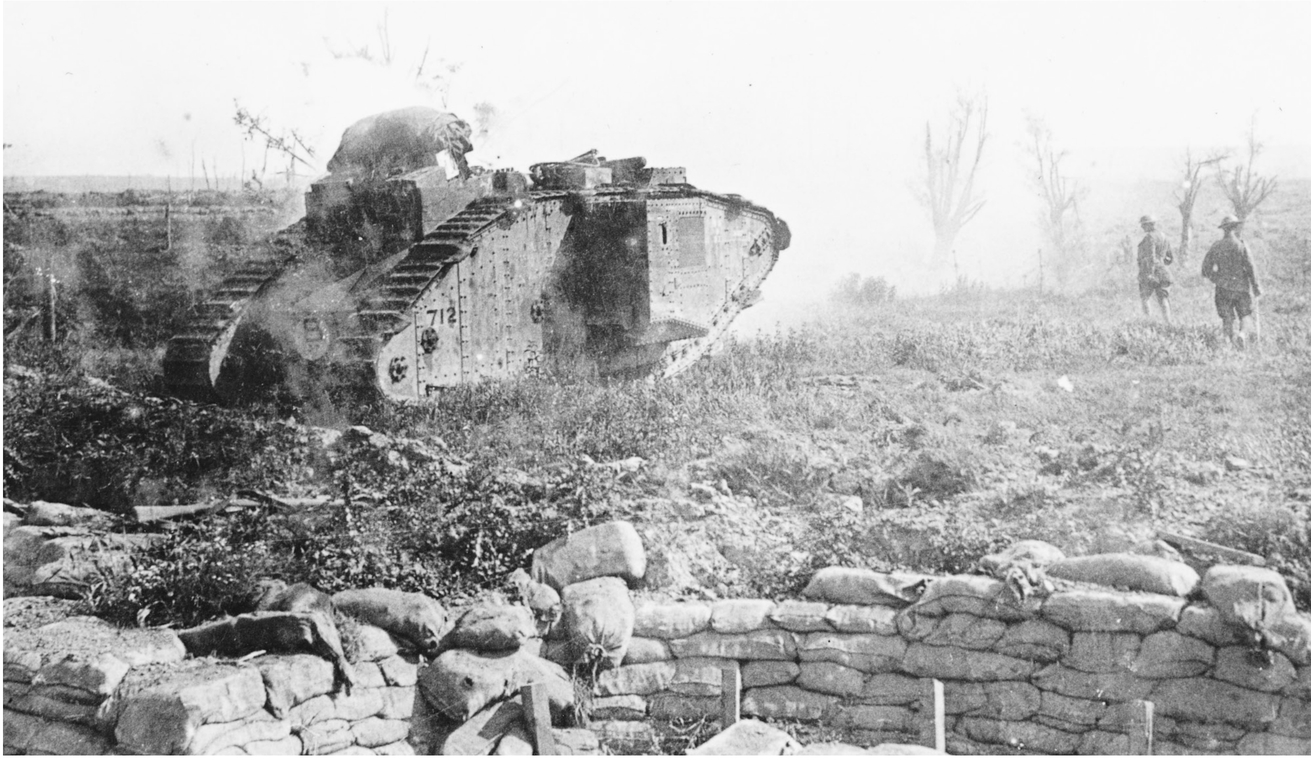
At least one Mark I female took part in special sea-wall-climbing trials in France in connection with the abortive Operation *Hush*, the proposed amphibious landing on the Belgian coast. The trials involved fitting special spiked shoes to each track link so that the tank could heave itself, in a series of violent jerks, up the wall and over the lip. Subsequent training would involve Mark IV machines scheduled for the actual assault.

As part of the preparation for what became known as the second battle of Cambrai in September 1918, some other tanks were modified. A scheme was devised whereby tanks could cross the dry bed of the incomplete Canal du Nord, where it was at its deepest and most impressive, over a causeway formed from three old tanks which had been stripped and strengthened for the task. The only evidence that the tanks concerned were actually Mark I machines is a suspect comment to the effect that they were old Somme veterans, but in any case the operation never took place; the three tanks, precursors of the Ark tanks of World War II, all broke down before they could be used.

Finally, mention should be made of a Mark I that was still around in November 1918. Stripped of its sponsons, the tank was equipped with a Westinghouse generator and Portable Tank Crane, mounted on the nose. Hanging from the crane by a chain hoist was an enormous electro-magnet, supplied by the Ingranic Company, and the idea was to use it as a safe method of lifting mines. Trials at Esher, in Surrey, revealed that the device did not work.

It remains to record that the only surviving Mark I, which sadly cannot be identified, was given to Lord Salisbury in 1919 and placed on his Hatfield Park estate to commemorate the events of 1916. Shorn of its original guns, it was fitted with a pair of shorter weapons from a Mark IV which were cosmetically extended when the tank was finally passed to the Tank Museum in 1970.

Fully stowed Mark I supply tank moving up at Messines. There is a stowage box between the rear horns, another on top and more stores simply dumped on the roof. Notice how the gun position has been filled in and that this tank is fitted with track extenders.



THE MARK II TANK

PRODUCTION	
Male tanks	776–800
Female tanks	576–600

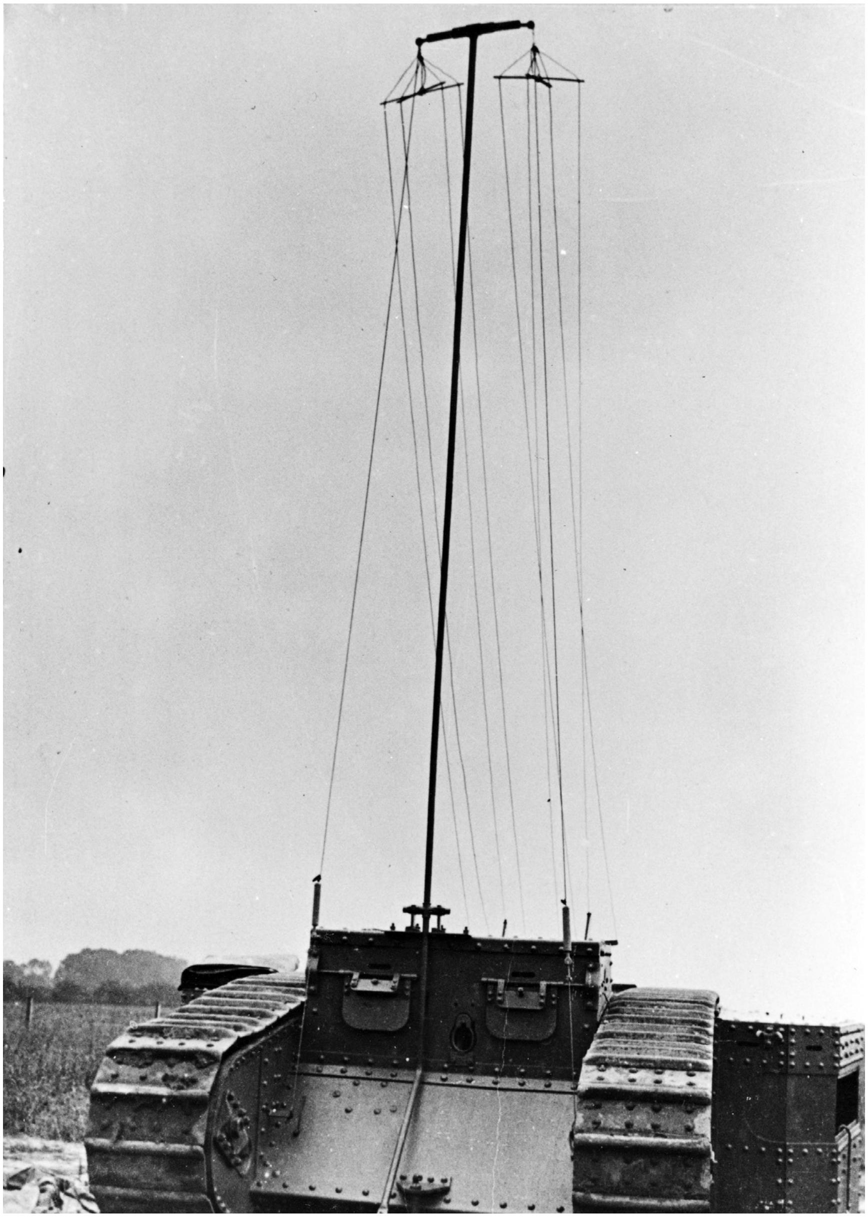
General Haig's demand for 1,000 new tanks and the problems that presented have already been mentioned. There was an immediate requirement for extra tanks on which to train the crews for this new tank army and this was resolved by ordering 100 interim machines. Since they were only required for training it was agreed that there was no need to subject them to the full armouring process – they would be assembled from mild steel, or boilerplate. However, at the same time it made sense to try out a number of new ideas, only matters of detail but significant nevertheless. The tanks would be built in two batches of 50, each batch subdivided equally into 25 male and 25 female examples. The first 50 would be designated Mark II. Deliveries had begun by December 1916 when nine of the new training tanks were recorded as being at Bovington.

The 25 male tanks came from Fosters, the females from Metropolitan. Outwardly they are difficult to distinguish from the Mark I, having the same hull form and sponsons, but there are noticeable detail differences. For a start the new tanks had slightly narrower cabs – in order to allow for wider tracks – which resulted in an uneven arrangement of rivets along the top. Track adjustment was increased by 1½in, which resulted in a different shape for the apertures on the front horns. Most significant of all, however, was a fixture, not unlike the cover of a traditional cheese dish, which replaced the manhole hatch on top of the hull. Sloping forwards, with a large, hinged lid and protected loopholes at the sides, it provided an observer with a means of looking out from an elevated position in relative safety, and was also an extra means of escape for the crew.

The idea of steering tail wheels having been abandoned, the hydraulic jack went too, leaving the area between the rear horns looking decidedly bare. Despite the fact that these tanks were unarmoured, the principle of improved protection was under constant review. Various experiments with so-called burster plates had been conducted and the idea of bolting additional plates directly to the sides of the hull was considered for the Mark II. In the event this was never done, but the completed tanks all had the extra holes, filled with bolts.

As training tanks, the Mark II machines were unlikely to make a great impact upon history, but in fact five of them were earmarked for a highly significant purpose. Even from the start it was clear to most people that a tank which required four people to drive it was hardly ideal. Walter Wilson understood this better than most, and even had a more practical system in mind. Albert Stern, who was responsible for tank supply, was unable to appreciate Wilson's genius, so he set an open competition for anyone who could come up with a better system. Five tanks were diverted from the Metropolitan production line and issued, without sponsons or even such fittings as visors, to the competing firms.

One of the tanks seems to have gone to France to be fitted with the St Chamond petrol-electric transmission, but it was not ready for testing in time. The other four were remarkably varied. One was fitted with a simple epicyclic final drive devised by Walter Wilson, another used a hydraulic system manufactured by the Williams-



A Mark I wireless tank, a converted female machine, with its aerial array rigged. Notice the opening in the side of the sponson. Wireless tanks continued to be used throughout the war, but whether they were all Mark Is is not clear.

Janney Company, while British Westinghouse produced a petrol-electric drive as used in tramcars. Finally, a designer by the name of Wilkins offered a dual gearbox system that looked extremely complicated and, in the event, failed to compete.

The trial took place on 3 March 1917 at the Oldbury Testing Ground in Birmingham. Only three of the Mark IIs took part but they were joined by the prototype tank Mother now fitted with a Daimler petrol-electric drivetrain. The result, which should have been a foregone conclusion, was an outright win for Wilson's design which incorporated a simple but effective epicyclic arrangement in place of the secondary gears. Subsequently one of the trial tanks was altered again, with the addition of a Lanchester gearbox, but precise details have not survived. Surviving records show that this tank was also fitted with a Ricardo 150hp engine.

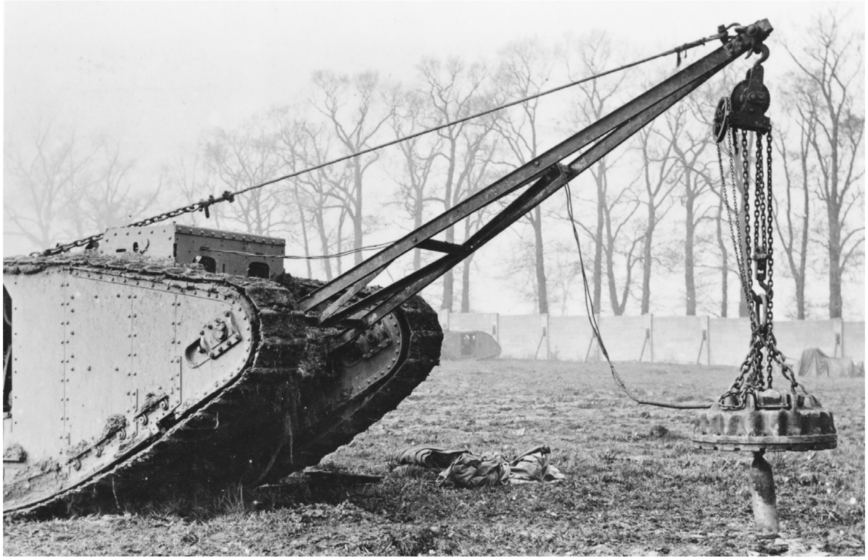
THE BATTLE OF ARRAS

As already recorded, 26 Mark II tanks were despatched in a hurry to France to participate in the Arras battle in April 1917. It was a desperate move, since at close range they were vulnerable even to machine-gun fire, but there was no alternative. Photographic evidence suggests that the females among them were fitted with sponsons from Mark I tanks, since these can be seen to be camouflage-painted while the rest of the tank was not. Bearing in mind the covering of mud which soon plastered itself all over the tanks, the authorities had agreed not to waste time and paint on such decoration and, from January 1917, had all new tanks painted all over in a muddy shade of khaki brown.

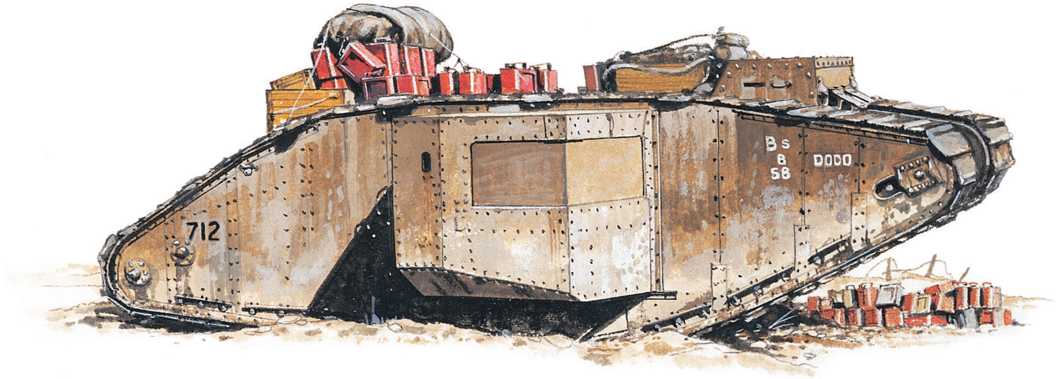
The change of sponsons, which appears to have been limited to female tanks only, at least rendered some part of these tanks armoured. There had also been another change. Over the winter of 1916/17 an officer with experience of machine guns convinced the War Office that the air-cooled Lewis gun would make a far better weapon for tanks than either the big Vickers or the secondary Hotchkiss. Central Workshops in France record converting 62 tanks – both male and female – to accept the Lewis gun.

Returns from the battalions which operated tanks in the period 9 April–3 May 1917 show that 60 machines saw action: 25 Mark II males and 20 Mark II females, along with 15 of the old Mark I pattern (seven males and eight females). The five missing Mark II females from the batch of 50 are those converted for use in the Oldbury transmission trials. Another feature typical of the tanks at Arras was a track extension plate, which bolted onto the original link and spread the weight pending the arrival of wider tracks. They appear to have been attached to every sixth track plate in most cases, but there were endless variations. Yet another local modification was an open stowage box, attached to the back of the hull between the horns, in the space where the tail would have been.

The series of battles known to history as Arras and Bullecourt were affected by three factors. First was the German withdrawal from their old front line to formidable new positions, which the Allies called the Hindenburg Line. This caused the British command to revise its plans. Secondly, as on the Somme, tanks were separated into



The converted Mark I mine-lifting tank photographed at Dollis Hill, London, in 1918. The Portable Tank Crane was mounted on the nose, and the huge electro-magnet is seen gingerly lifting a shell. Presumably this could only be done by a soldier operating the chain hoist from the ground, which seems very risky.



MARK I SUPPLY TANK *DODO* OF B BATTALION, Heavy Branch, Machine Gun Corps; Messines, 7 June 1917

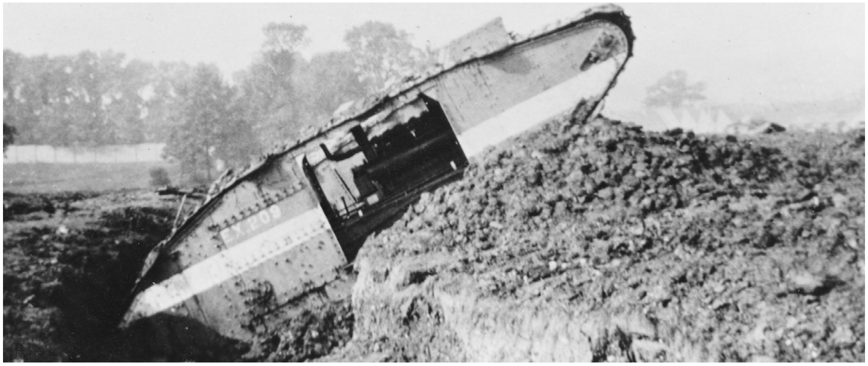
To convert these tanks, the guns, shields and mountings were removed and the aperture in each sponson was plated over in mild steel. The space created in the interior could then be used for storage, with loading being done through the sponson doors. Trays for carrying more stores were provided on top of the hull and between the horns at the back. Inside the tank wire screens are said to have been fitted to prevent stores from falling against the engine or into crew spaces. One supply tank was capable of carrying sufficient stores to resupply five fighting tanks in the field.

Supply tanks would require a crew of four to manipulate the controls, and for defensive purposes a single Lewis machine gun was mounted in the front of the cab.

F Battalion also received six supply tanks when it drew its equipment in June 1917 and these were issued on the basis of two per company, forming a separate supply section within each company. Two of this battalion's tanks were named *Fill Up* and *Follow the Crowd*. Before the battle of Cambrai supply tanks were removed from company control and placed under the battalion. (Art by Tony Bryan, © Osprey Publishing)

small groups to attack specific targets which inevitably led to a patchwork of success and failure with most of the groups spread out too far apart to offer mutual support. And third was the weather. A wet spring meant that the ground was still soft in many places and, to give one example, all of the tanks allocated to the Canadians for their historic attack on Vimy Ridge got bogged down long before they could get into action. Further south a few days later snow was the problem.

On 11 April D Battalion supported an Australian attack and for the first time some effort was made to concentrate the tanks. Unfortunately overnight snow reduced visibility and obliterated the white guide tapes so that tanks became lost on the approach route and arrived late. Those that did get into action gave the Germans excellent targets against the snowy ground and it was believed at the time that two tanks were captured intact. There is no doubt that a number of tanks were knocked

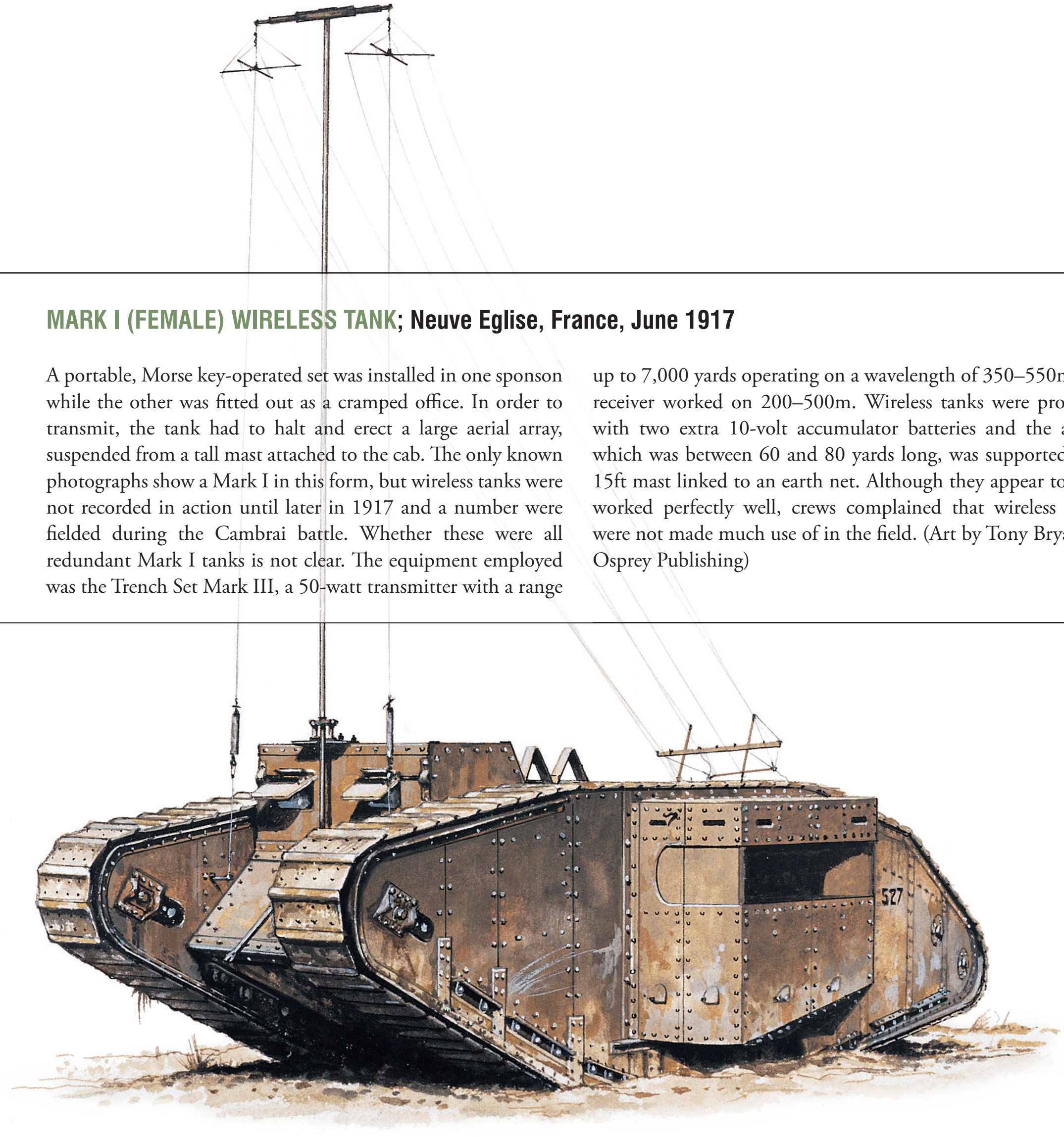


Experimental machine 209, one of the Oldbury Trials tanks, crossing a trench at Dollis Hill. The broad coloured stripe served to identify competing machines. The five Mark II tanks all ran without sponsons and many other detail fittings were not attached.

out within the German lines, but whether any were mobile enough to be of any use to their captors is not clear. If, as some claim, the Germans used these tanks to test armour-piercing ammunition, they could not have obtained worse samples. Unarmoured Mark II tanks would hardly keep ordinary rifle bullets out and this seems to have created a false sense of security that the Mark IV would soon disabuse.

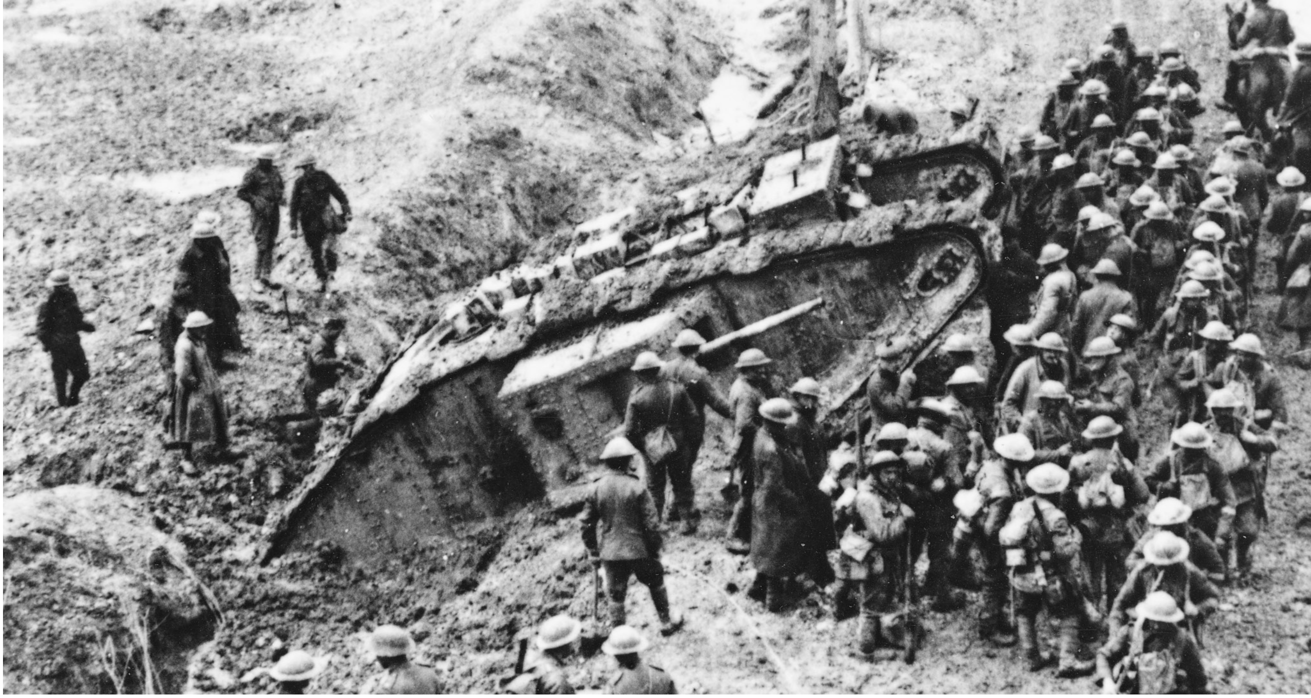
The only recorded modification to a Mark II, apart from those used in the experimental transmission trials, was a supply tank photographed in July 1917 when Queen Mary visited what by then had become the Tank Corps at Neuve Eglise. This would be one of the 12 supply tanks already mentioned, but how many of these were Mark Is and how many Mark IIs is not recorded.

After the war one of the Arras veterans was given what might be described as a retro-modification back to the outward semblance of a Mark I, complete with a tail assembly and one male and one female sponson, for display purposes in Britain. This tank, now restored to its original form as a Mark II, survives in the Tank Museum collection.



MARK I (FEMALE) WIRELESS TANK; Neuve Eglise, France, June 1917

A portable, Morse key-operated set was installed in one sponson while the other was fitted out as a cramped office. In order to transmit, the tank had to halt and erect a large aerial array, suspended from a tall mast attached to the cab. The only known photographs show a Mark I in this form, but wireless tanks were not recorded in action until later in 1917 and a number were fielded during the Cambrai battle. Whether these were all redundant Mark I tanks is not clear. The equipment employed was the Trench Set Mark III, a 50-watt transmitter with a range up to 7,000 yards operating on a wavelength of 350–550m; the receiver worked on 200–500m. Wireless tanks were provided with two extra 10-volt accumulator batteries and the aerial, which was between 60 and 80 yards long, was supported by a 15ft mast linked to an earth net. Although they appear to have worked perfectly well, crews complained that wireless tanks were not made much use of in the field. (Art by Tony Bryan, © Osprey Publishing)

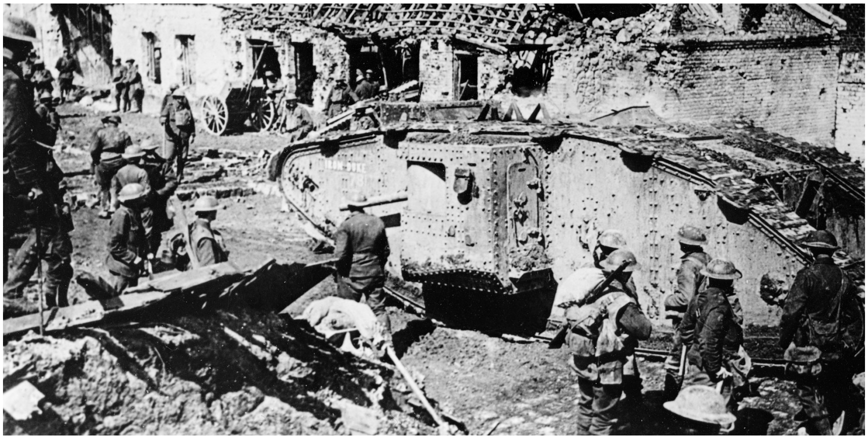


The only known view of a Mark I at Arras, 2nd Lieutenant Tarbet's C6 (No. 752) ditched close to the Blangy Road. Shorn of its tail and fitted with track extension plates, it can only be identified by the shape of the track adjustment recess, which is more rounded than on the Mark II.

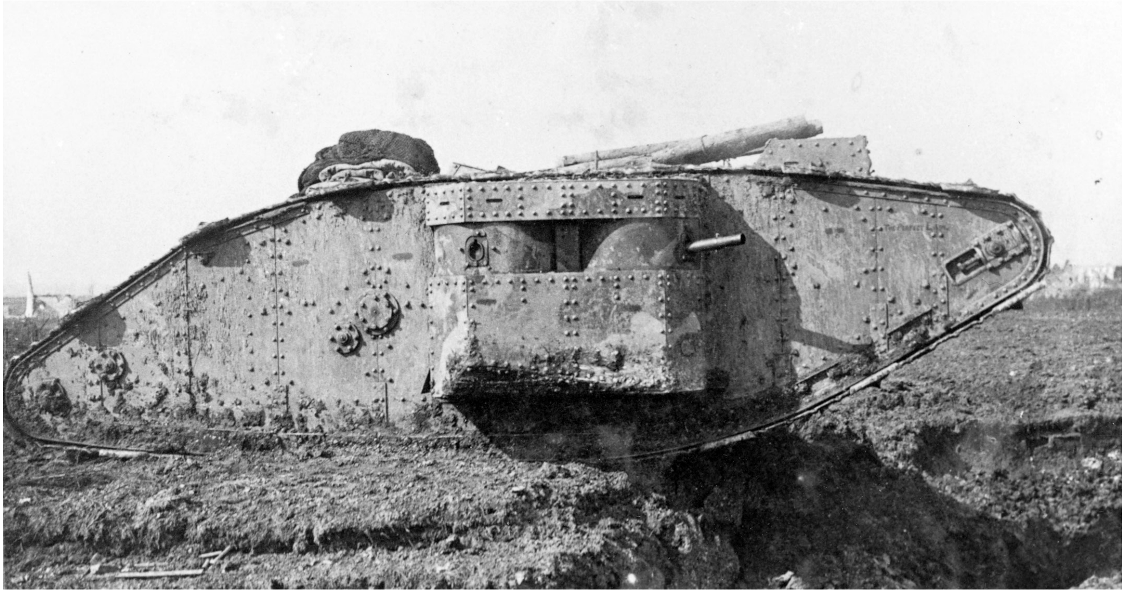
THE MARK III TANK

PRODUCTION	
Male tanks	801–825
Female tanks	601–625

The second interim batch of 50 tanks, designated Mark III, was assembled by Metropolitan. Once again they were unarmoured – in the sense that the plate had not been heat-treated to make it bullet-resistant – but on the flanks the plate was now 12mm thick instead of 8mm, to test out another feature scheduled to be introduced on the Mark IV. This made the tank half a ton heavier than the Mark II. Visually they were identical, apart from tiny detail differences on the front of the cab, but the transition to the Lewis gun caught the Mark III at an earlier stage of production, with interesting results.



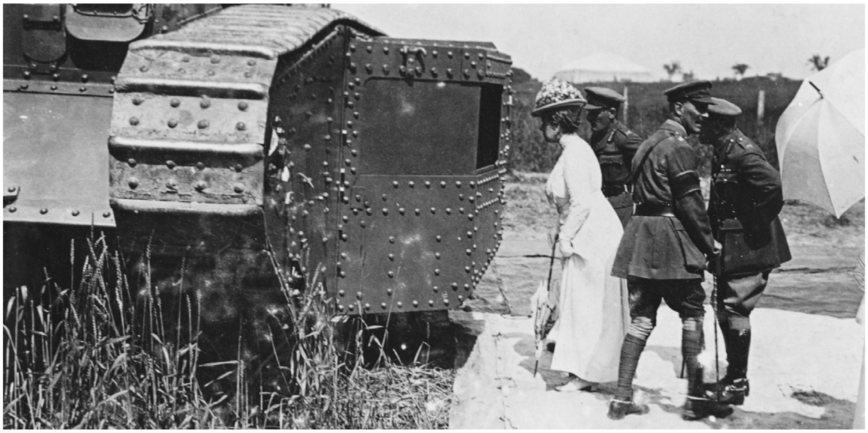
Iron Duke, a Mark II male, makes its way through Arras displaying well the track extenders, V-shaped exhaust baffles and a new style of roof top hatch. Notice how mud smears the lower extremities of the sponson and is piled on top from the action of the tracks.



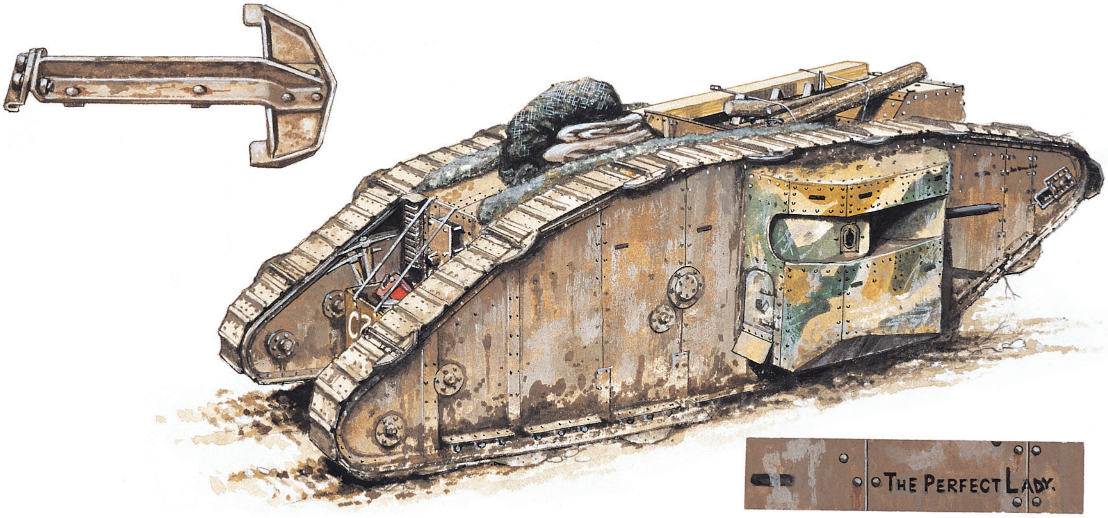
A Mark II female, *The Perfect Lady*, at Arras. The camouflaged sponson must have come from a Mark I, but it now carries a pair of Lewis guns. It seems that the crew have painted artificial vision slits on the hull and sponson sides. German soldiers were ordered to aim specifically at vision ports.

For a start the cab front of every tank had a larger orifice to accommodate the ball mounting for the Lewis and, more fundamentally, a new style of female sponson appeared. A meeting in October 1916 decided that, apart from being of thicker plate, the sponsons of the Mark III should be identical to earlier models. This ruling was followed in the case of male tanks but, although one or two female Mark IIIs were photographed with the old-style sponson, the majority carried a much smaller structure which only occupied the upper half of the opening in the hull side. Being a much lighter weapon, the Lewis did not require such a large sponson and the gunners worked on their feet, if not exactly upright. The entire arrangement was much simpler; it still enabled the two guns to sweep a considerable arc of fire and crew escape facilities were vastly improved. The lower half of the opening was filled with two large doors, flush with the side of the tank and opening outwards from the centre, which could be kicked open in a hurry, enabling members of the crew to roll out very quickly if the tank caught fire.

One source claims that 50 training tanks went to France and 50 remained in Britain, but it is unlikely to have been as neat as that. For one thing we know that 26



Queen Mary gazes into the blanked-off sponson of a Mark II supply tank. This is a good point to examine the rivet pattern along the top of the cab, which is a distinguishing feature of Mark II and III machines. This inspection took place at Neuve Eglise in the summer of 1917.



MARK II (FEMALE) TANK C21 *THE PERFECT LADY* OF C COMPANY, Heavy Branch, Machine Gun Corps; Battle of Arras, April 1917

The tank is finished in overall khaki brown but female tanks appear to have carried camouflaged sponsons from old Mark I tanks. A new feature, first seen at Arras, was a wooden box marked with the crew number and located between the rear horns but offset to the left, clear of the small back door. This was boldly marked with the crew number in white, presumably for the benefit of accompanying infantry and other tanks.

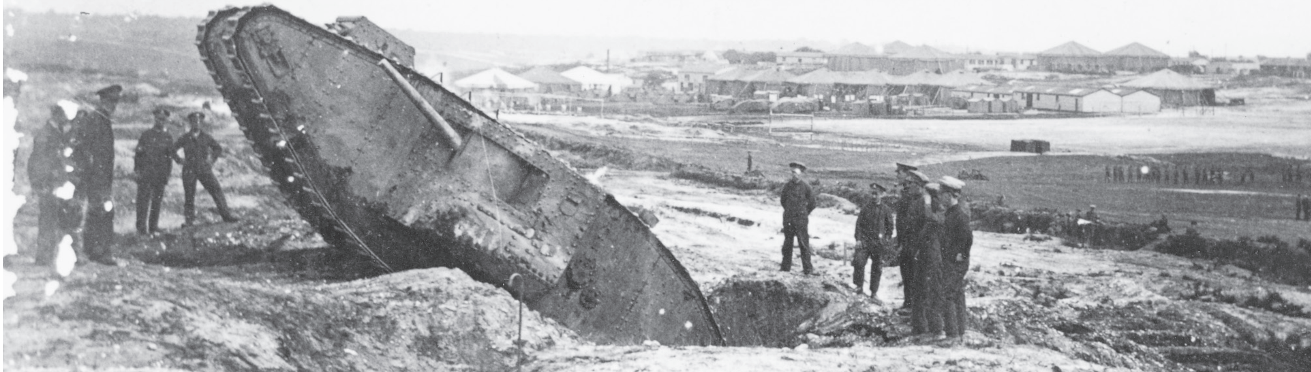
Pending the arrival of wider tracks, special bolt-on extension pieces were provided, and for a long time it was believed that these were a feature peculiar to the Mark II. In fact they could be fitted to any tank, at least up to the Mark IV, and were certainly still in use at the battle of Cambrai in November 1917. They would be clamped to individual track plates and had two functions. The more obvious was a reduction in ground pressure, but they also provided a raised lip to the plate, which could provide additional grip in certain conditions. Even so, they were a mixed blessing, since they might twist a track plate out of shape and must have been extremely difficult to remove after a time. (Art by Tony Bryan, © Osprey Publishing)

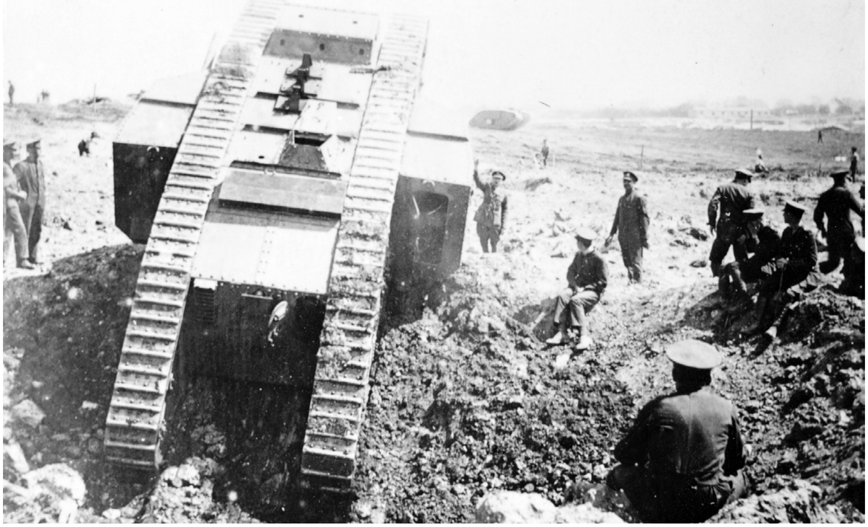
tanks from Bovington were rushed out to France for the Arras battle and these must have been Mark II machines in order to bring the total with those already in France up to 45. This in turn suggests that the 50 training tanks at Bovington must have been Mark IIIs, with perhaps a few surviving Mark Is. This may be confirmed by the negative fact that Central Workshops records never mention the Mark III either by title or number.

A few of the male Mark III tanks photographed at Bovington sported the long 6-pdr guns, but the remainder seem to have operated with empty sponsons. This may have been due to a shortage of these weapons, but they were not essential to driver training in any case.

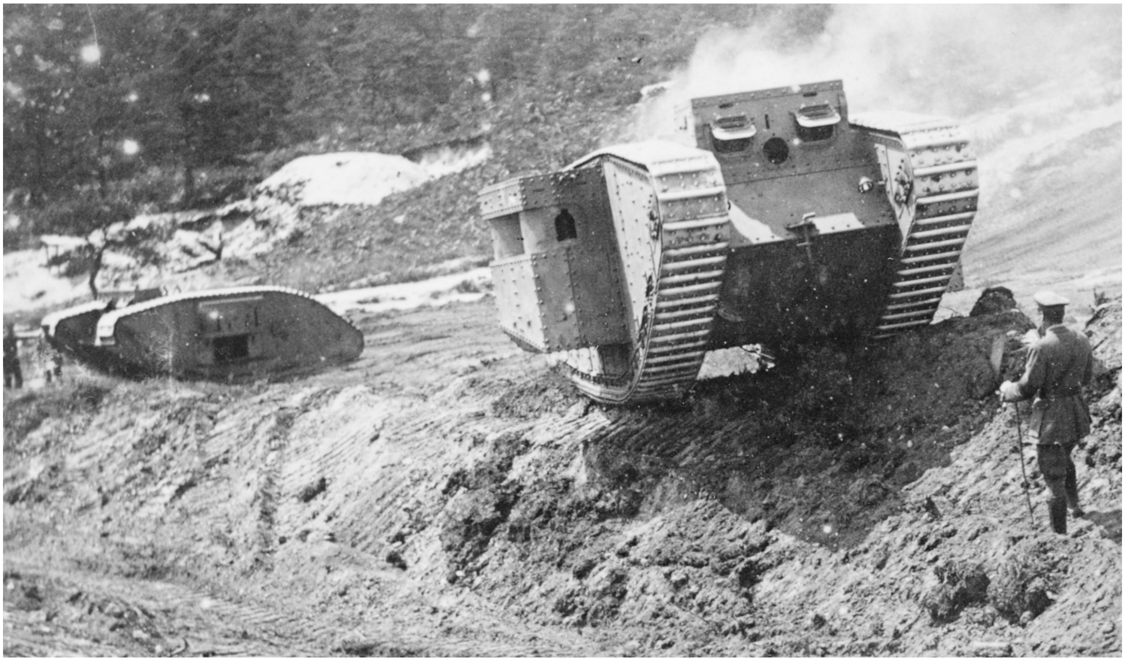
A feature of the training scheme appears to have involved getting the tank stuck

With the new military settlement of Bovington Camp in the background, a male Mark III, complete with guns, demonstrates the technique for getting out of a difficult hole. Traces of camouflage along the top of the sponson and on the gun barrel suggest this may have been taken from a redundant Mark I tank.





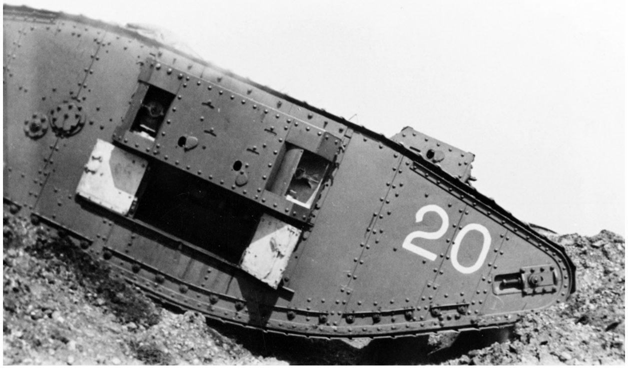
Most Mark III male tanks photographed at Bovington ran with empty sponsons. From this unusual angle one can see how the sponson door, roof hatch and even the small oval door at the back are all open, no doubt in order to alleviate conditions inside.

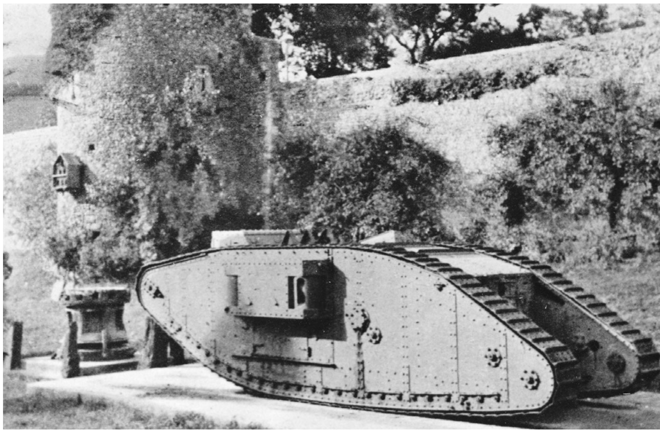


A Mark III female tank, with the old-style sponsons, training at Bovington. Glancing at the cab front one can see the round hole for a Lewis gun and the way the vision slits have been raised to a point just below the lip of the cab roof. These are two key identification features of the Mark III.

in a shell hole or trench and then challenging the crew to get it out. A good deal of digging was often involved, although various devices were also tried as an aid to unditching. The most successful, up to this time, seems to have been the torpedo spud, a piece of round timber with a metal collar around its middle which could be bolted to each track and carried round until it provided a purchase upon which the tank could grip. Photographs reveal that this device was carried by some Mark II tanks during the Arras battles.

After the war at least two Mark III females, with the smaller sponsons, were delivered as souvenir tanks to communities that had raised money for National War Savings Committee schemes. Maidstone and Canterbury both had Mark III machines, but they are now long gone.





Above An excellent view of a Mark III female with the smaller Lewis gun sponson. The escape hatches below the sponson are wide open and the two rotating shields for the machine guns have been turned to face inwards. Notice also the clevises, or hooks, at each end of the sponson for lifting it off.

Above right Photographed with other items in the Moat Gardens at Canterbury some time after the war, this Mark III female was one of at least two of the type that served as souvenir tanks for towns and cities in Britain which had raised appreciable sums in War Bond sales. Most tanks used in this way were Mark IV machines, all but one of which had gone by World War II.

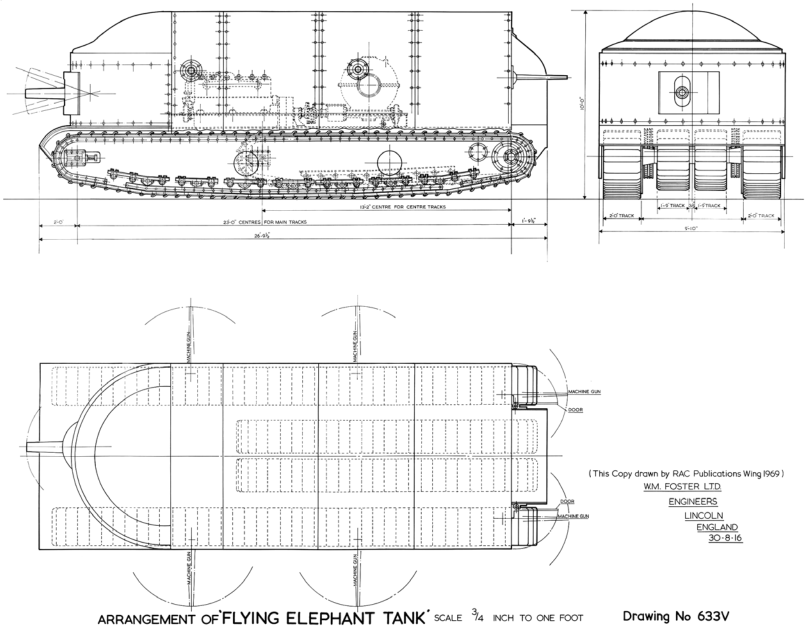
THE FLYING ELEPHANT

Ever ready to run before they could walk, the erstwhile Landships Committee, now reconstituted as the Tank Supply Committee, wrote to the War Office on 14 February 1916 announcing that 100 tanks ‘according to the sample inspected’ were under construction, but that they still had a sum of money earmarked for experimental purposes. They proposed to use these funds to build a prototype of a superior machine with better armour protection than the type then building, which would be proof against high-explosive shells from German field guns as well as small-calibre rounds from quick-firing guns.

They wanted to know whether the thing they had in mind should be armed with a field gun. The War Office replied that a 6-pdr would be good enough, but that the machine should be able to manage 6mph and be able to cross a ditch up to 10–12ft wide, or a 6ft parapet with a trench 4ft 6in wide behind it. Trials at Shoeburyness revealed that armour 2in thick would be needed to resist such rounds, and that this would result in an overall weight of 100 tons.

The project was handed to William Tritton, who prepared various drawings and came to the conclusion that a pair of Daimler six-cylinder engines, delivering 210hp, would be required to drive it. The two engines were ordered from Daimler in Coventry, and the plan was to install them side-by-side inside the vehicle with a common crankcase. They would drive back via a pair of gearboxes, although the final drive arrangements are not revealed. The 6-pdr gun was to be located at the front, although the projected arc of fire is not entirely clear. Six machine guns were to be mounted – two each side and two more at the back – but it is not clear where the driver was supposed to go.

A pair of supplementary tracks was located under the chassis but raised clear of the ground, to be clutched in if the vehicle became bogged down. No ground pressure is actually given but, since it was about the same size as the gun carrier machine but over three times its weight, something in the region of 45psi is probably not far off, bearing in mind that its tracks were planned to be 2ft wide. Overall dimensions were 10ft high, 26ft 9in long and 9ft 10in wide. Development of the prototype was cancelled in December 1916 because, we are told, mobility was thought to be a better defence than thick armour, although the top speed of a Mark I tank was only 3.9mph whereas the top speed of Flying Elephant was estimated at 2mph. Indeed


13-2" CENTRE FOR CENTRE TRACKS
2-0"
23-0" CENTRES FOR MAIN TRACKS
1-9½"
26-9½"
10-0"
2-0" TRACK
1-5" TRACK
1-5" TRACK
2-0" TRACK
5-10"
MACHINE GUN
MACHINE GUN
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MACHINE GUN
(This Copy drawn by RAC Publications Wing 1969)
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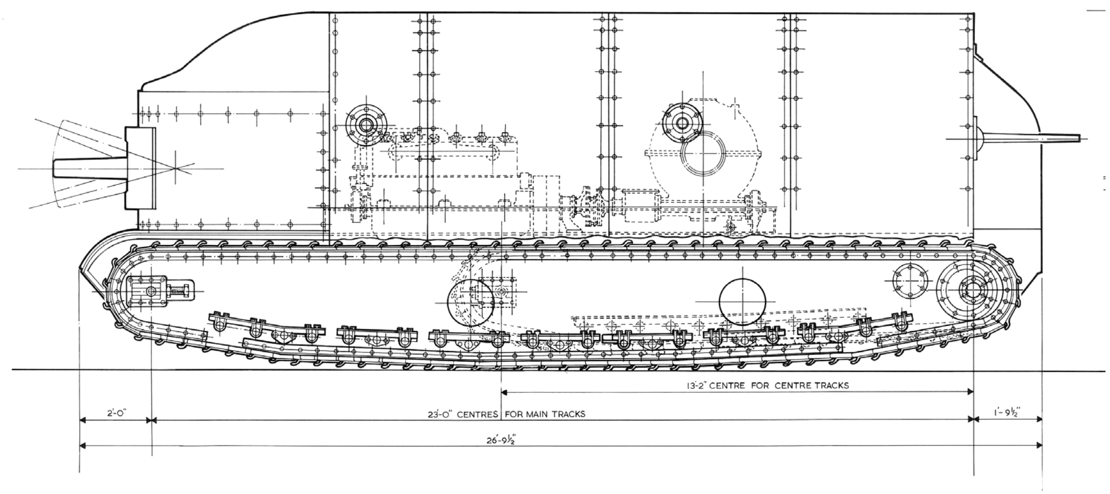
ENGINEERS
LINCOLN
ENGLAND
30-8-16
ARRANGEMENT OF "FLYING ELEPHANT TANK" SCALE 3/4 INCH TO ONE FOOT
Drawing No 633V

Left A full three-view drawing of the Flying Elephant, copied from a tracing of the original by Matt Sampson. Some details of the engines and transmission are shown in the side elevation, but notice the underslung tracks in the front view.


13-2" CENTRE FOR CENTRE TRACKS
2-0"
23-0" CENTRES FOR MAIN TRACKS
1-9½"
26-9½"

Below A side elevation drawing of the Flying Elephant, with the engines and transmission ghosted in. There is a 6-pdr gun in the nose, but the machine guns, two in each side and two more at the back, cannot be identified.

even with the power of two engines, moving a vehicle weighing 100 tons would be quite a challenge. Nor is it clear where the name came from, although it appeared on some original drawings and may only have been a nickname used at Fosters.

Some sources claim that the Flying Elephant was nearly completed at the time it was scrapped, but William Rigby, who had been head draughtsman at Fosters at the time, said that only parts of the chassis frame had been started and the modified Daimler engines delivered.

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CHAPTER 3

THE MARK IV TANK

The Mark IV could probably be described as the first main battle tank. Some 1,200 were built and they participated in virtually every British battle on the Western Front from the early summer of 1917 until the very end of the war, plus one action in the Middle East. Apart from its mass production, the Mark IV was also the first tank to be built based upon experience with earlier tanks and the first to be used en masse in combat, in a battle actually planned around the tank. Even so, it could have been a far better machine had it not been for a serious clash of personalities.

The Mark IV was based, mechanically, on the prototype tank Mother, which in an ideal world should have been improved upon by 1917. The problem was the eternal conflict between the ideal and the expedient. Everyone agreed that the four-man driving system, introduced with Mother in 1915, was tiresome and inefficient, but what to do about it?

Lieutenant Walter Wilson knew the answer, but Major Albert Stern, head of the Mechanical Warfare Department, overruled him. Lacking technical acumen, and unable to see the brilliant simplicity of Wilson's scheme, Stern ordered this first

The tank testing ground at Oldbury, near Birmingham, with a brand new Mark IV female ticking over. The Royal Naval Air Service petty officer stowing fuel cans belongs to 20 Squadron, which remained responsible for tank testing until the end of the war.

production tank to use the same system as Mother, while experiments were carried out to find the most effective form of transmission. The matter was decided in favour of Wilson's design in competitive trials at Oldbury in March 1917, but that was too late to influence the Mark IV. Stern had unwittingly managed to delay the improvement of British tanks by a good 18 months.

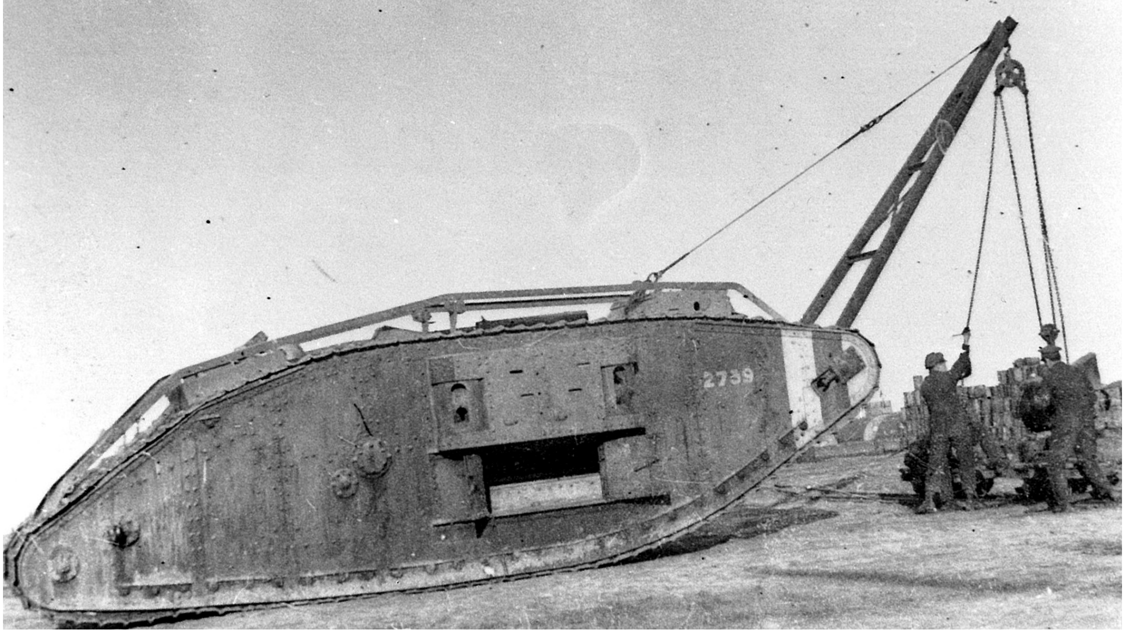
HAIG'S ORDER

As noted earlier, immediately after the very first tank attack in September 1916, General Haig placed an order for 1,000 more. These would appear in due course as the Mark IV. Meanwhile the surviving Mark Is would have to soldier on. They were supplemented by small production runs of Mark II and Mark III machines, which would be required to train the new army of tank crews to be raised for the Mark IV. It is difficult, today, to appreciate the implications of Haig's order. British manufacturing industries were already groaning under the strain of war. The great shell scandal that could have brought the British Army to its knees in 1915 was only slowly being overcome, now that dozens more firms had taken up the work. The British railway system was nearly falling apart as it struggled to meet increased demand and the shipbuilding industry was working to full capacity, endeavouring to produce more warships and replace merchant vessels lost through enemy action. On top of these conditions there was an increasing demand for aircraft, transport vehicles, rifles, grenades, mortars and all the other materiel of war.

THE NUMBERS GAME

Production of Mark IV tanks got underway in March 1917 as soon as the last Mark II and Mark III machines were finished. Deliveries were soon running at about 20 tanks per week, although it was hoped that double this number would be produced. Not everything was running smoothly. Considerable confusion followed the placing of the 1,000-tank order and it was not settled until Prime Minister Lloyd George intervened, at which point the War Office took a more optimistic view and authorized what amounted to an open-ended order. At one stage the total number of Mark IV tanks on order was 1,400. Ordering like this was a risky business. It should have been a foregone conclusion that improved designs would appear; indeed the Oldbury

Opposite King George V and Brigadier General Hugh Elles watch two new Mark IV tanks on a steeplechase course at Neuve Eglise in July 1917, the month that the Tank Corps came into being. The event provides a fine comparison between male and female models.



A Mark IV female fitted with a portable tank crane lifts heavy items onto light railway wagons, probably at the depot in France. The jib is secured to the back of the cab and employs a manual chain hoist.

Trials had only recently guaranteed this. So orders assuming that the present type would be manufactured for an infinite future threatened to clog existing production facilities, probably at a critical time.

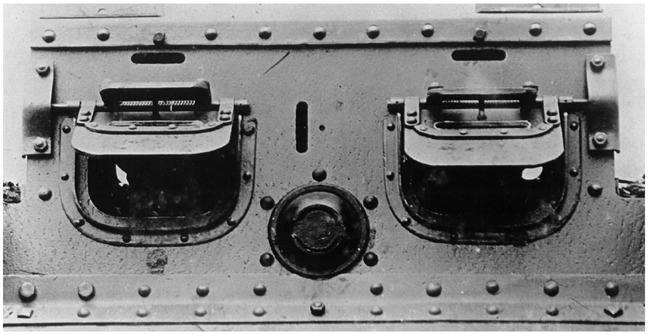
The initial confusion over quantities is reflected in a good deal of uncertainty over individual orders as to who got what and how many tanks each firm would actually build. Overall, out of the total of 1,400 the following is believed to be an accurate breakdown:

Cancelled	180
Fighting tanks	950
Supply tanks	205
Experimentals	11
Surplus	54

Therefore, of the 1,220 Mark IVs actually built 1,155 were available for combat or training, if one includes the supply tanks. As we shall see, far more Mark IV tanks were ultimately used for experimental purposes than those shown here, and were presumably earmarked for this role from the outset. Whether the others were adapted from redundant service tanks or the surplus stock is not clear. Other figures suggest that of the 1,015 fighting, experimental and surplus tanks – that is excluding supply tanks – 420 were completed as male machines and 595 as female.

Since it is fair to assume that any firm not engaged in war work by 1916 was not much good, the only answer to increased production was to spread the work between the good manufacturers. The main contractor would still be the Metropolitan Carriage, Wagon and Finance Company of Birmingham, and Fosters of Lincoln would take its share, but other firms were now brought in, notably Beardmores, the Coventry Ordnance Works and Mirrlees Watson in Glasgow, plus Armstrong-Whitworth in Newcastle-upon-Tyne. Sub-contractors would also be drawn in, such as the Daimler Motor Company, understandably, for engines, gearboxes and differentials, and others like the Glasgow firms Hurst, Nelson Ltd and John Brown and Company, which assembled tank hulls for parent contractors.

Haig's great hope was to have enough new tanks available for a proposed offensive in the spring of 1917, but for a variety of reasons delays combined to frustrate this plan. Raw materials were in short supply, new contractors had to be educated, and there were numerous design changes to be worked out and incorporated, although some had been foreshadowed in the Mark II and III.



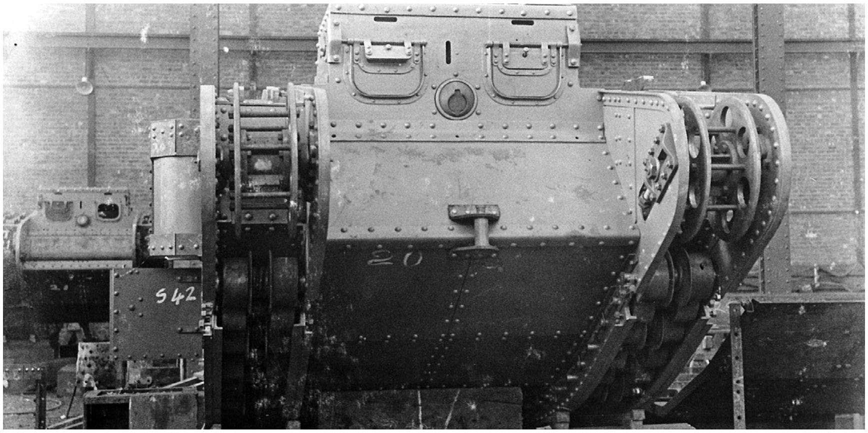
A close look at the front plate showing the two-stage hinged visors, the vision slots and the plugged ball mounting for the Lewis gun. The rivet and bolt arrangement along the top is a significant identification feature of the Mark IV. The brackets on top were intended to be supports for camouflage.

THE MARK IV DESCRIBED

Perhaps the simplest way to describe those things that changed and those that did not would be to compare the Mark IV with the Mark I, starting at the front.

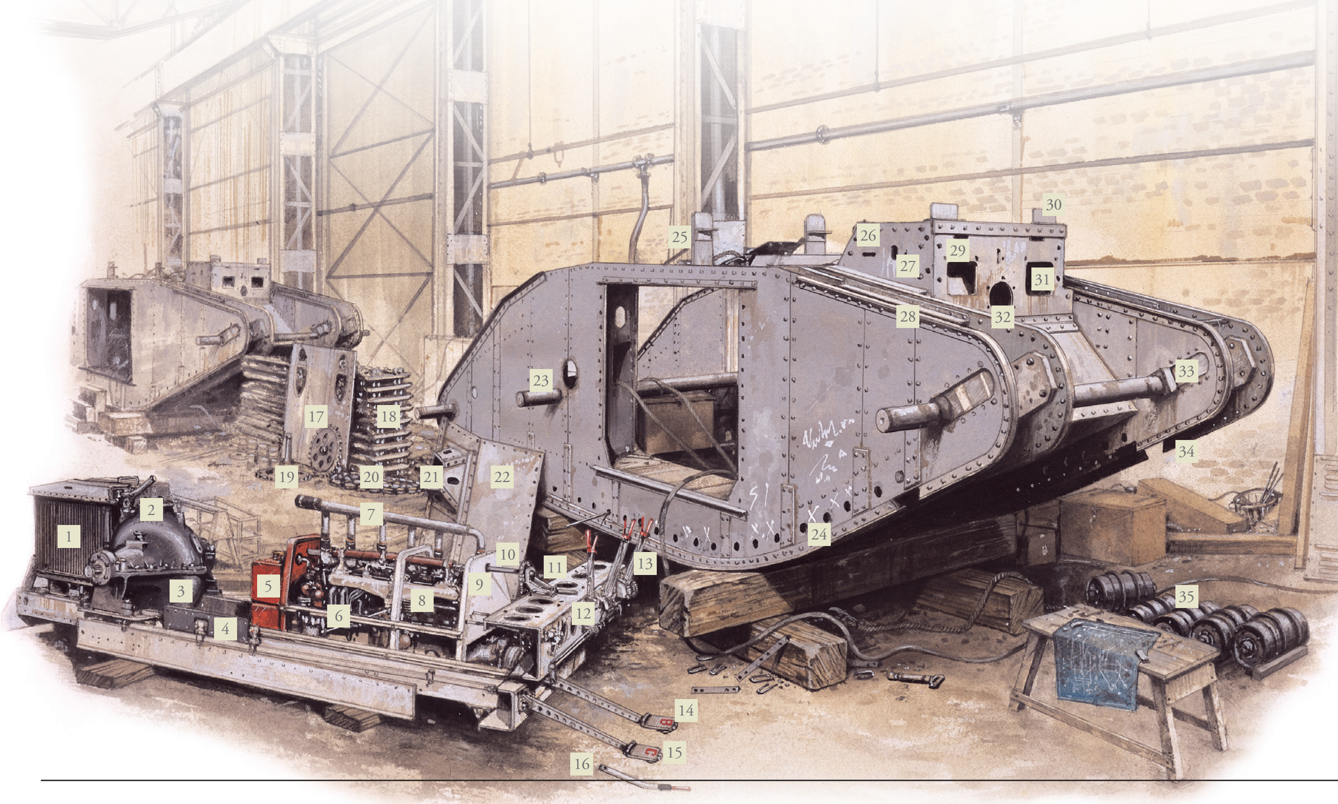
The process of up-armouring successive types of tank started in a very modest way. The practice began with the Mark II and was standardized on the Mark IV. The front of the Mark IV's cab remained at 12mm, but the area covered by 8mm plate was extended along the sides in order to provide better protection for the crew and the main mechanical components. The less vulnerable areas beneath the tank and at the rear remained at 6mm thickness. Little could be done to improve the quality of armour. The science of producing thin, bullet-proof plate was still in its infancy; the plate still had to be worked by rather old-fashioned tools and a fair amount had to be rejected as inadequate or too brittle.

The layout of the cab front, one of the best guides to accurate identification of the different marks, was nearly identical to that of the Mark III. The cab was narrower than the original Mark I version in order to leave room for wider track plates, once these became available, but this feature had been introduced with the Mark II. Hinged visors for the driver and steersman remained the same and the vision slits directly above them were tucked up beneath the lip of the angle iron running along the top of the cab – here is the place to look for a difference. Insignificant as it may be, it is the spacing of the rivets along this strip that conclusively identifies a Mark IV from Marks II and III. On the latter vehicles a pair of rivets will be found at each end of the strip, closer together than the rest. On the Mark IV the rivets are all equally



Front view of a Mark IV female at Beardmore's in Glasgow. This view shows clearly the alternating flanged and unflanged rollers, the toothless idler wheels and the flanges, on the lower frames, which support the tracks.

MARK IV TANK UNDER CONSTRUCTION, JOHN BROWN & COMPANY, CLYDEBANK, MAY 1917



Key

1 Radiators
2 Differential lock lever
3 Differential housing
4 Primary gearbox
5 Oil tank
6 Engine governor
7 Coolant circulation system
8 Inlet manifold
9 Crank handle extension shaft
10 Starter drive chain
11 Starter engagement lever
12 Primary gear lever
13 Steering brake levers
14 Foot brake pedal
15 Foot clutch pedal
16 Hand assist lever for clutch pedal
17 Rear hull plate
18 Track plates
19 Drive sprockets
20 Final drive chain
21 Rear roof hatch coaming
22 Rear roof panels
23 Shaft used for hull alignment
24 Hole for track roller spindle
25 Rear camouflage support bracket
26 Cab side vision slit
27 Cab side loophole
28 Upper track support rail
29 Cab front vision slit
30 Forward camouflage support bracket
31 Commander's visor opening
32 Aperture for Lewis machine-gun mounting
33 Slot for idler spindle and track adjuster
34 Location of track switch plate
35 Track rollers

spaced. This pattern is repeated on the angle iron at the rear of the cab roof.

What this design difference reveals is important. It shows that new armour plate jigs had been prepared for the Mark IV, whereas the interim Marks II and III were built on and adapted from the old Mark I tank jigs. For example, the sloping plate below the cab front was now plain; there was no sign at all of the large bolts or filled bolt holes indicating where the tail steering wheel was located on the Mark I.

Another change relates to the machine-gun armament, which will be covered in more detail later. As ever, preliminary evidence is visible on the Mark III with the

This illustration is derived from a photograph of a Mark IV tank being assembled. At this stage all the hull plates are in natural metal and long steel rods are being used to line up frames to ensure accuracy. The top plate is yet to be fitted, but this cannot be done before the engine assembly has been dropped into place.

The engine, gearbox and differential have been delivered from Daimler in Coventry. They are assembled together on a sub-frame complete with all driving controls and the radiator. Once these elements are installed, the sides of the engine will be covered in with sheet-metal panels and an exhaust stack will be fitted linking the manifold with a silencer on top.

Other items can be seen stacked around the tank. The rollers will be located in the series of holes along the bottom of the frames, with track-adjusting idlers at the front and track drive sprockets at the rear. Finally the tracks will be fitted, the tank lowered to the ground and driven out of the building. In Glasgow new tanks were moved through the streets at night on large trailers, hauled by steam road locomotives to a specially prepared testing ground at Scotstoun. (Art by Tony Bryan, © Osprey Publishing)

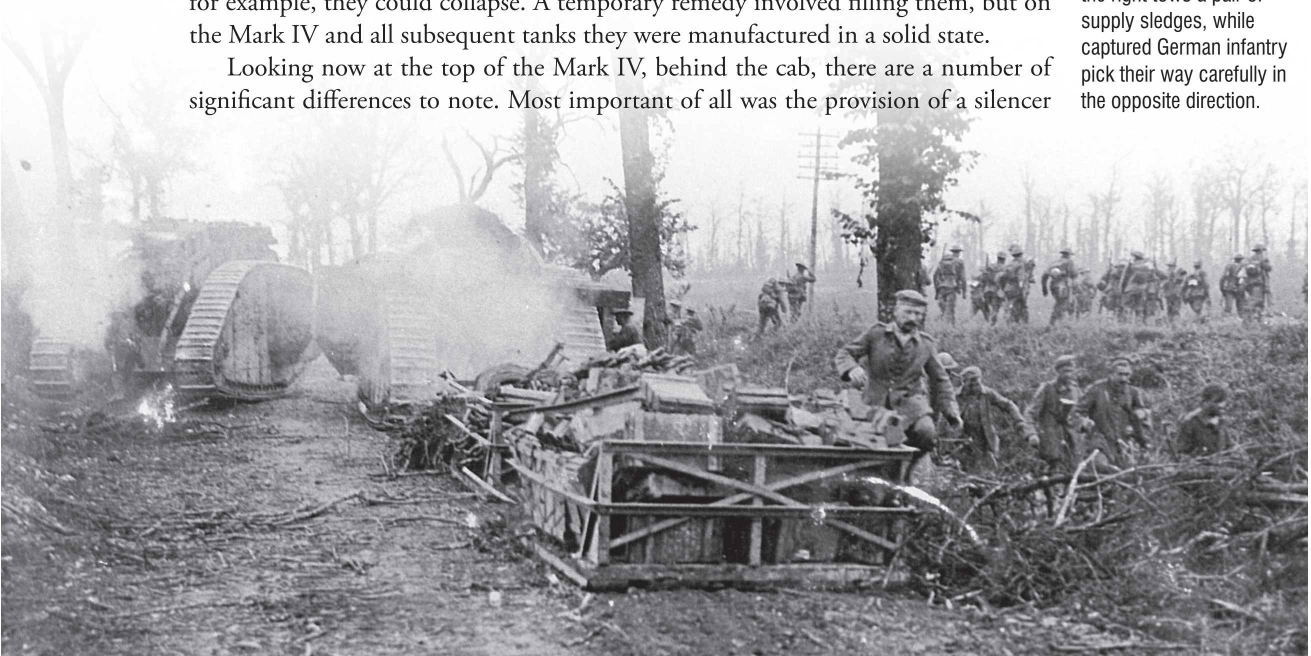
Specifications

Crew: eight
Weight: 27.9 tons
Power to weight ratio: 3.7bhp/ton
Overall length: 26ft 3in
Overall width (male): 13ft 6in
Overall height: 7ft 11in
Engine: Daimler/Knight sleeve valve, water-cooled straight-six 105hp @1,000rpm
Transmission: two-speed and reverse primary box with secondary two-speed selectors on the output shafts
Fuel capacity: 70 gallons
Max speed: 3.69mph
Radius of action: 35 miles
Fuel consumption: 2.08 gallons per mile
Trench-crossing capability: 11ft 5in
Armament: two 6-pdr (57mm 23-calibre quick-firing guns and four .303-cal Lewis air-cooled machine guns
Muzzle velocity (6-pdr): 1,348ft/sec
Max range (6-pdr): 7,978 yards
Ammunition: solid shot, high explosive and case
Ammunition stowage (male): 332 rounds of 6-pdr, 6,272 of MG

appearance of a large, round opening between the two visors, which was designed to accommodate a ball mounting for the Lewis gun instead of the narrow slot provided for the Hotchkiss.

No change is evident in the tracks. The wider type was not available until 1918 and, if photographic evidence is any guide, none was ever fitted to the Mark IV. However, based upon experience with the Mark I, the front idlers, or track-adjusting wheels, were smooth rather than fitted with teeth to engage the tracks, a configuration that caused endless problems. Among various criticisms of the original design by the engineer and Tank Corps officer Philip Johnson was one concerning the robustness of the track rollers. As originally built these were hollow and, on occasions when a lot of weight was brought to bear upon a few of them, as when passing over a fallen tree for example, they could collapse. A temporary remedy involved filling them, but on the Mark IV and all subsequent tanks they were manufactured in a solid state.

Looking now at the top of the Mark IV, behind the cab, there are a number of significant differences to note. Most important of all was the provision of a silencer

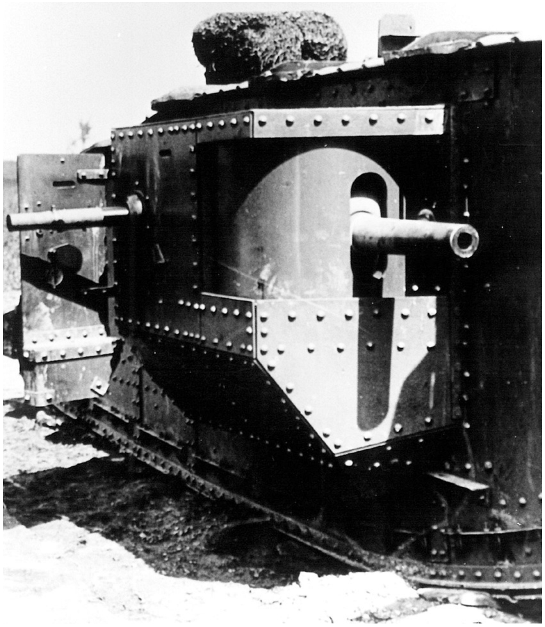


Photographed near Bapaume in September 1918, two Mark IV supply tanks move forward shrouded in clouds of exhaust fumes. The tank on the right tows a pair of supply sledges, while captured German infantry pick their way carefully in the opposite direction.

for the engine exhaust system. The lack of this simple device was a serious inconvenience for early tank crews. It was not just the noise that was the problem, although that was bad enough, but the great cloud of fumes from the Daimler engine that hung over each tank – and at night a red glow and occasional sparks from this area – that gave the tank's position away. Everything had been tried, from applications of wet mud to improvised silencers, but a type designed specifically for the engine was clearly the answer. It was aligned to cover the three exhaust outlets and ended in a long tail pipe that ran along the roof and down the back to end between the track horns. This system not only eliminated the noise and heat problem on top; it also dispersed the fumes in a less obvious place and, most important of all, reduced the external noise. Men present at the Cambrai battle in November 1917 often remarked on how quiet these tanks seemed to be when at rest or moving slowly with the engine on tickover. It was quite a different matter inside, of course, but it did mean that tanks could crawl up to their start lines without too much risk of alerting the enemy.

The round hatch on top of the Mark I tank had already been replaced in the Mark II with what is often described as a trapezoid-shaped structure, and this was repeated on the Mark IV. If the tank's commander could be spared from his usual duty of operating the steering brakes he could, by standing on the gearbox cover behind the engine, raise the lid and have a look round in relative safety. At the rear, where the roof sloped down to meet the back plate, the manufacturers provided a stowage tray formed from side panels of light steel, and this was normally used to carry bulky items such as the camouflage net, towing cable, extra fuel cans and track extension plates when they were not fitted.

The wheeled steering tail had already been removed from surviving Mark I tanks and was never seen again on any service tanks. This arrangement released a space between the rear track horns, which was now given over to a vital improvement. Enclosed within an armoured box, low down at the rear, was a 70-gallon fuel tank that replaced the two 25-gallon tanks either side of the cab in earlier models. This was a considerable advance in terms of safety and it extended the tank's potential range by an average of 10 miles. At the same time it gave the designers a new problem to solve. The original arrangement, dangerous as it was, enabled fuel to run by gravity feed to the carburettor. Now, with the fuel at a lower level, some form of delivery system was required. The original scheme seems to have been to employ an air pump, which was a standard fitting on the Daimler engine, but this was not entirely satisfactory, so a proprietary product known as the Autovac was installed which, as its name implies, worked on a vacuum principle.


A male sponson, starboard side. The short 6-pdr gun in its rotating shield casts a shadow on the lower, more angular plates. Farther back is a Lewis gun in the ball mounting, looking massive. Notice that, in contrast to the Mark I, the door on a Mark IV male sponson swings outwards.

Inside the tank there are other things to note. At the front, on either side of the cab where the fuel tanks had been, new features were installed: on the right was an open storage space alongside the driver, and on the left a locker for the officer and a container for drinking water. Even so, on active service, there was never enough room to stow everything that was required. On either side of the engine, the floor would be cluttered with additional stores.

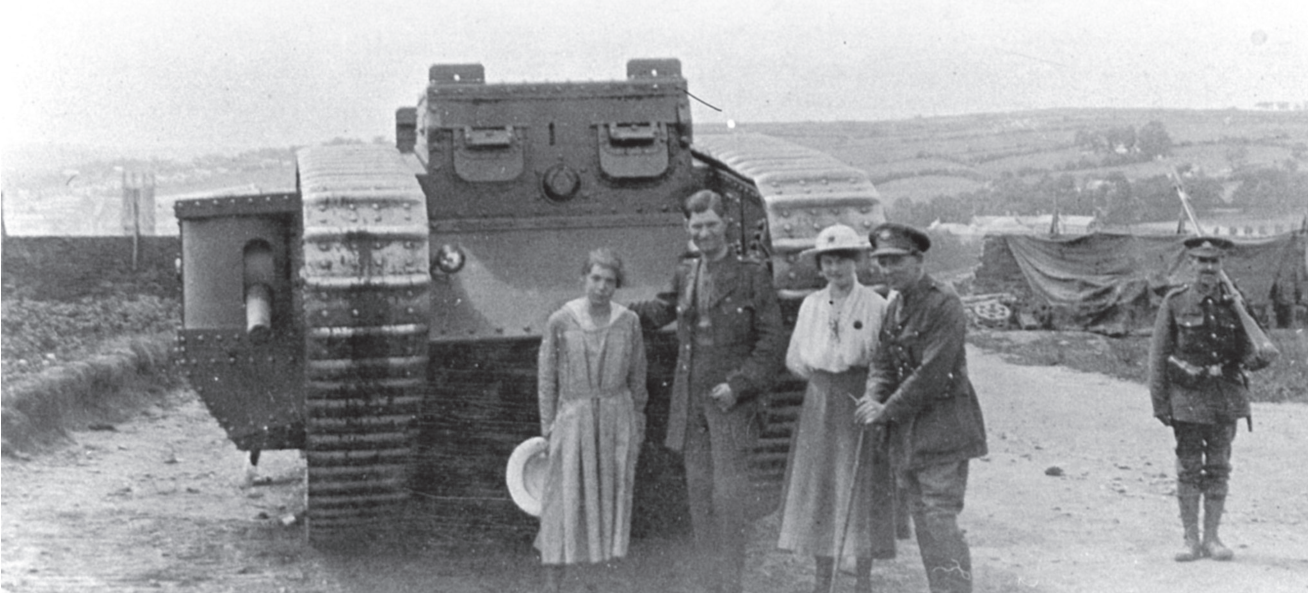
WEAPONS AND SPONSONS

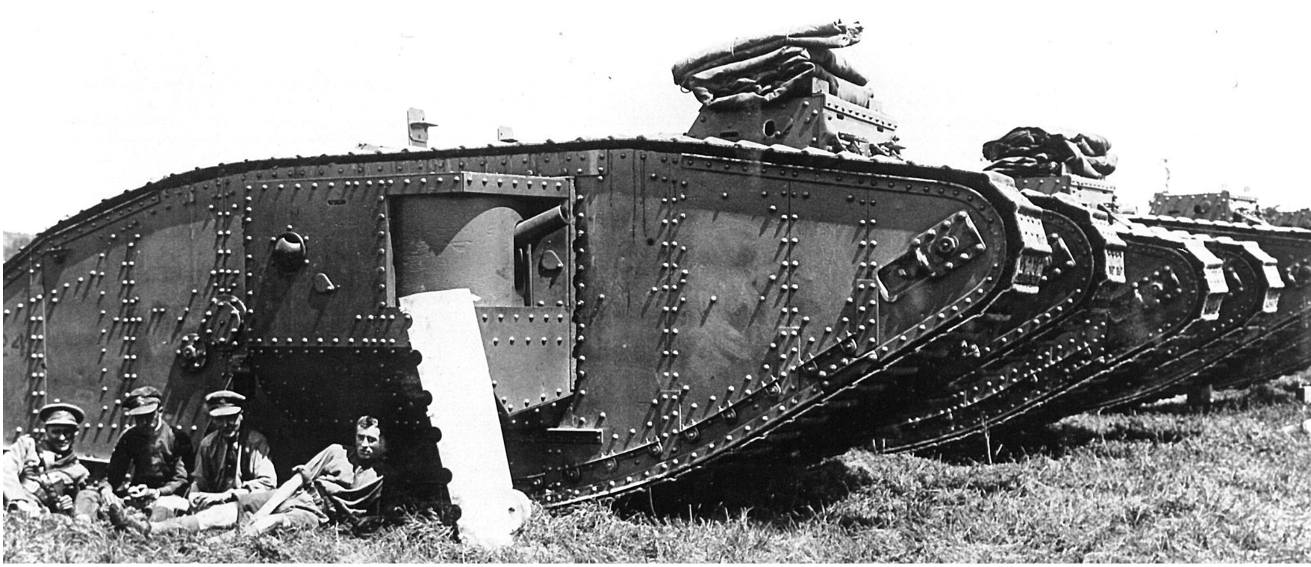
Changes of armament and the shape of the sponsons that mounted them are undoubtedly the most significant features of the Mark IV. In the male type there were two problems to be faced. The first was supply; the original 'long' 6-pdr of the Mark I was still in demand for the Royal Navy and, indeed, it was a shortage of these weapons that led to the adoption of female tanks in the first place. Second, tank crews had discovered that the gun was too long. Not only was it easily clogged with mud if the tank leaned over too far on soft ground, but it was also liable to damage from striking trees or man-made structures still standing on the battlefield that the crew, from inside, did not notice.

As a consequence a new weapon was designed, which was essentially a shortened version of the original. Known officially as the Ordnance Quick Firing 6-pounder 6-hundredweight Mark I, it had a barrel length of 23 calibres instead of the 40 calibres of the original weapon. This was a shortening of 38in, and under normal circumstances this should result in a loss of accuracy at longer ranges and a lower muzzle velocity. However, the former was not a problem since tanks engaged their targets at relatively close range, and the effective muzzle velocity was in fact little different, as the longer guns – having been made as single tube rather than by a built-up technique, to ease production – were limited to a lower charge for safety. The shorter gun was also single tube but a good deal thicker at the breech end, so that the standard charge could be fired. Firing data for the 'short' gun included a maximum range of 7,300 yards at a muzzle velocity of 1,350ft/sec. Firing solid shot it was estimated that the gun could penetrate 1 ⅕in of armour at 500 yards. High-explosive ammunition was also available.

The new gun was adopted in January 1917, but it is likely that the design of the new male sponson may have anticipated this. Experience in the field had shown that the original male sponson, which was deep at both front and side, had a tendency to embed itself in mud when the tank was not running level, and if there was one chore the crews cordially hated it was having to remove and reattach these sponsons every time tanks had to be moved by rail, which was the normal method. Thus the new sponson was designed to be slightly smaller all round and more bevelled on the lower surfaces to avoid close contact with mud. This improvement, and the adoption of the shorter gun, meant that for rail journeys the sponsons could be closed up, inside the tank, in order to reduce the width.

This Mark IV, which rejoiced in the name of *Whiskey and Soda*, served in Ireland, where two young officers show it off to their lady friends. It may have been a rare example of a Mark IV hermaphrodite with a male sponson on the starboard side.





A new Mark IV male and some of its crew relaxing in the sun. Someone must be working on the engine; note one half of the engine cover leaning against the sponson. The 6-pdr gun tube has been run back as it would be when the sponson was withdrawn.

Not that this procedure was a simple exercise. First, the guns had to be put on full elevation and the barrels run back as far as they would go. Then, in a sequence of prescribed moves, the two sponsons were unbolted and swung inboard one end at a time to be secured by a pin and clevis arrangement to the main engine bearers. There were other problems for the crew. The driver and brakeman were virtually trapped in the cab, which is why a roof hatch was later introduced, while the secondary gears could only be operated if the sponson doors were lifted off their hinges and stowed separately.

It is now generally accepted that the adoption of the Lewis light machine gun as the secondary weapon in male tanks and the main armament of females was a mistake. Undoubtedly the big, water-cooled Vickers used on the first tanks was too cumbersome and required a massive female sponson, but the Lewis gun, good as it was in the field, was not suited to tanks. The Lewis was an air-cooled gun that worked by drawing air through the barrel casing at the breech end, but this flow was reversed by the action of the tank's own cooling fan, which meant that warm air from the gun, along with fumes from the muzzle, flowed straight into the gunner's face every time it fired. It was not a disastrous failing but was by no means ideal, and the Tank Corps managed to live with it throughout 1917. The officer believed to be responsible for this change was Lieutenant Colonel Baker-Carr, a machine-gun expert who later commanded 1st Tank Brigade.

The Lewis gun was not only lighter than the Vickers, but it hardly required a mounting in the traditional sense at all. What it did need was a fairly large aperture in the armour and this was resolved by designing a very effective form of ball mounting. Essentially this was a solid steel ball, with a hole big enough to accept the jacketed Lewis gun and a bit more for the sight. The ball moved freely within a phosphor bronze mounting so that the weapon could be aimed in any direction, and if the gun was withdrawn the ball would be turned sideways within the mounting, to seal it off entirely from the outside. One such mounting was provided in the cab front of both male and female tanks, another in each male sponson and two in each female sponson.

The design of the female sponson had already been seen on some Mark III tanks, but it was refined in the Mark IV. The upper part, with a gun mounting more or less at each end, was not unlike a small bow window in shape, but it was now in two halves so that it could be folded inwards from the centre sufficiently to clear the railway loading gauge. The lower part was filled in by a series of panels, two of which were hinged to open outwards. In theory, if the crew had to evacuate in a hurry they only had to kick release levers on the inside of these panels and roll out, clear of the tank. However, gruesome pictures from the aftermath of Cambrai show that sometimes even this was not enough.

Gunners on male tanks soon discovered that on the Western Front there was precious little above ground to shoot at. Since one had to stop the tank to ensure accuracy with the 6-pdr it was probably better to fire for effect and create a lot of noise than to actually try to hit anything. Most of the visible targets were human and machine guns were far more effective, since it did not matter very much whether the tank was moving or not when they were fired.

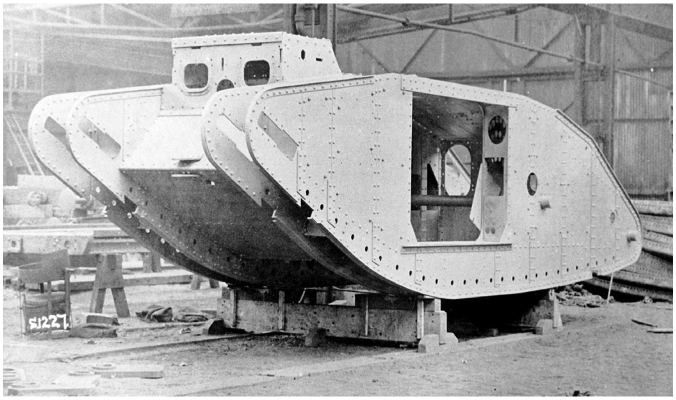
BUILDING THE MARK IV

Production of the Mark IV began in March 1917, some two months behind schedule. Despite the fact that the work was scattered in factories across England and Scotland, the big order involved a degree of standardization that might be seen as a form of mass production. The scheme involved building many parts of the tank as sub-assemblies before everything was brought together in the erecting shop for final assembly. This procedure involved the inner frames, with all connecting panels being assembled on jigs with the aid of power riveters before coming to the erecting shop, where hand riveting was employed to attach them to the floor and lower body panels. The outer frames were similarly assembled and then attached, and temporary long axles were used to line up the frames through the idler, secondary gear and sprocket holes. Meanwhile, the track rollers had been slotted into place so that their axles could be pushed through once the outer frames were fitted.

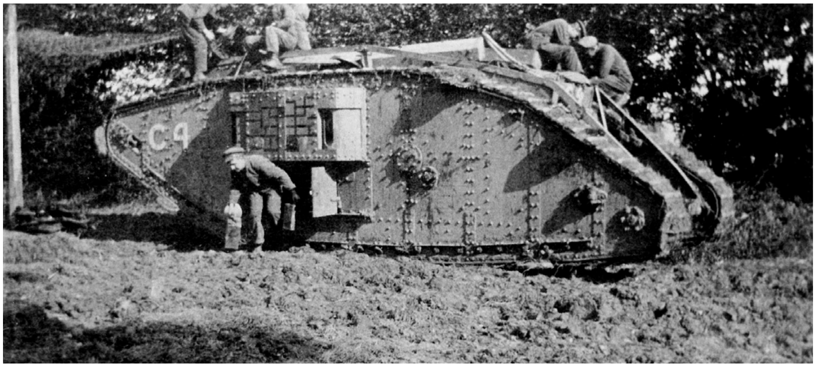
At this stage the tracks were laid out below the tank, which was then lowered onto them. Then the long axles were withdrawn while the gear wheels and sprockets were installed between the frames. The engine, gearbox, differential and control levers, which would have been delivered from the Daimler Company, were now lined up on a sub-frame and lowered into the tank from above, along with the radiator and fan assembly. Next the rear plate was riveted into place and the roof panels bolted on top; this was so that they could be removed to enable an engine to be changed. Engineers now attached the final details, including various internal and external fittings, the petrol tank and, of course, the sponsons. Finally the tracks were joined up, a coat of paint was applied and the new tank was driven out of the erecting shop ready for delivery. At this stage the vehicle would be without any weapons, which were a War Office responsibility.

THE TANK CORPS EXPANDS

Clearly, as the number of tanks increased the way they were organized would have to change. It was no good simply expanding the number of companies without arranging some sort of structure to manage them. So in October 1916 it



Hurst Nelson, a Glasgow-based rolling stock manufacturer, assembled Mark IV hulls for other Clydeside tank builders. The row of holes along the bottom will take track rollers and the large slots at the front show the location of the track tensioning fixtures.



C4 was a C Battalion tank, a female with a complicated pattern of dark lines painted on the sponson to conceal the vision slits. The crew, some in overalls, others in two-piece uniforms, are working on the tank which, bearing the name *Cyprus II*, fought at Cambrai.

was announced that the four existing tank companies in France would be expanded and elevated to the status of battalions, while five new battalions would be raised at home. In November the title of the tank forces was changed from Heavy Section to Heavy Branch of the Machine Gun Corps, which presumably indicated greater independence, but it was all largely academic until the new tanks were ready.

In fact at this time, at least in Britain, the administration was more concerned with the transfer of the home training base from Thetford in Norfolk to Bovington Camp in Dorset. Another administrative change in January 1917 saw the creation of the 1st Tank Brigade to oversee the activities of C and D battalions. This step was repeated in February when A and B battalions came under 2nd Tank Brigade.

The organization of a battalion went through numerous modifications on paper before it was confirmed. It would inevitably be a compromise between what was available in terms of tanks and men, and what was manageable in terms of structure and command. Finally, the authorities settled upon an arrangement whereby each battalion was split into three companies, but after that an element of choice appears to have crept in. For example, D Battalion's history is quite emphatic that throughout 1917 each company had three sections with four tanks per section (two male and two female if this could be arranged), whereas the history of G Battalion is equally clear that its companies were organized into four sections of three tanks each: one male and two female. Companies were numbered in continuing sequence so that A Battalion had 1st, 2nd and 3rd companies, B Battalion 4th, 5th and 6th and so on. Within the battalion, sections were numbered consecutively 1 to 9 or 12 and the tanks in the same way so that, for example, in A Battalion tank A1 would be the first of four tanks in the first of three sections in 1st Company. Not that it always worked out so neatly in practice. The first 76 Mark IV tanks to arrive in France were handed over to A and B battalions in 2nd Tank Brigade in May 1917 – they would be the first to take them into action.

Meanwhile, as they left the factories in Britain, new Mark IV tanks underwent a basic mechanical test on some adjacent site. In Birmingham, for example, this was at Oldbury, where men from 20 Squadron Royal Naval Air Service,

The scene alongside the rebuilt Menin Road shortly after the war showing the wrecks of three tanks that nearly made it across the swamp in the soggy summer of 1917. Over time they have been stripped of virtually every useful item.

maintaining the Admiralty link with 'Landships', put them through their paces in a large field that was soon churned into a landscape of mud. The new tanks were then taken by rail to Avonmouth, shipped around to Le Havre and then delivered, over the French railway system, to what became known as the Tankodrome at Erin, near St Pol, where they were tested again and prepared for service. Farther south, a section of the old trench system at Wailly, close to Arras, was acquired for use as a practical driving school. F (later 6th) Battalion was sent there on 1 June 1917, being newly arrived from Bovington. Here, according to its history, it took over a number of Mark IV tanks for driving instruction over the old German trenches. Tanks were not available for every crew so the work had to be done in shifts, but it was generally agreed that the training was invaluable.

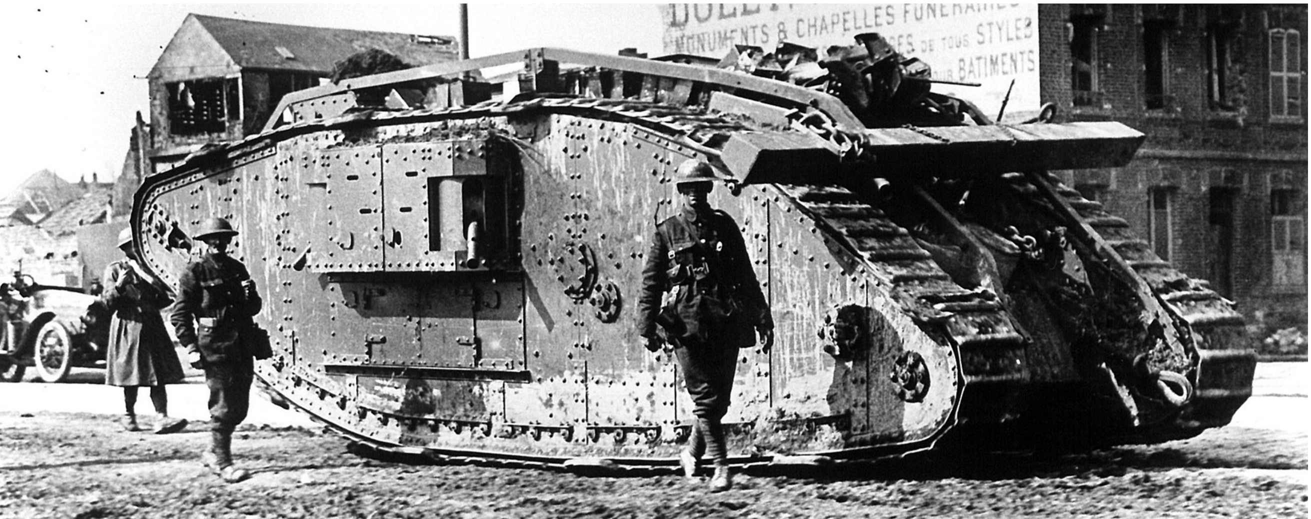
INTO BATTLE

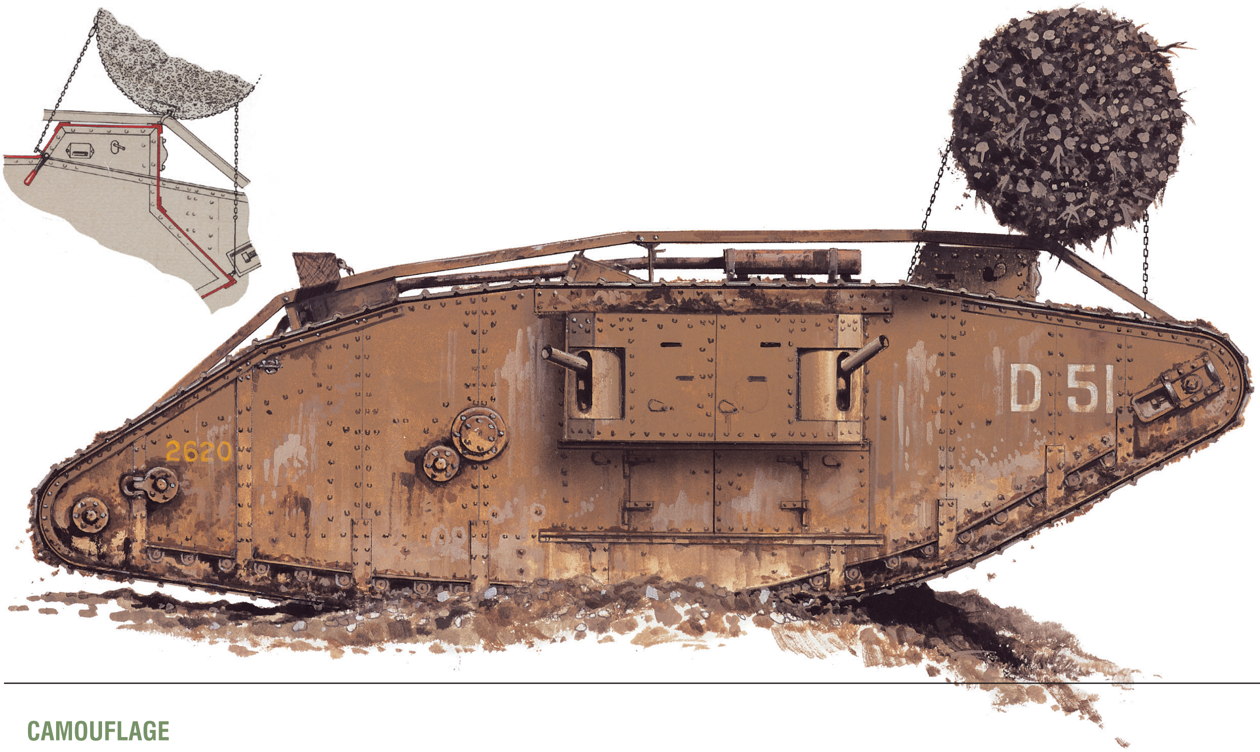
IN FLANDERS FIELD

The battle to take Messines Ridge was a curtain-raiser to Haig's plan for a summer offensive in Flanders, based around Ypres. The battle began on 7 June 1917 with a series of mines being set off beneath the German lines along a 10-mile stretch of the front. The results were so devastating that the infantry was able to swarm in at once, without much need for tanks which, in any case, were slowed down by the churned-up ground. Based on trials carried out against older tanks, the Germans were ready for them with a new, armour-piercing bullet, known as the 'K' round, which was fired from the standard German service rifle. However, the improved armour protection of the Mark IV was sufficient to defeat this projectile and two tanks, which became ditched during the day's fighting, were struck repeatedly by these bullets but never penetrated.

Ditching was the term used to describe what happened when a tank became stuck. Even on good ground this could occur. A trench that was too wide, or approached in the wrong way, could easily trap a tank. So could a large shell hole, but if the ground was waterlogged, churned up by shell fire and turned into a bottomless swamp, it was likely that ditching would become the norm rather than the exception when a 28-ton tank was driven over it. Indeed, ditching became such a feature of the tank experience throughout that summer that it very nearly led to the total demise of the tank. Even if tanks could keep going through the slough they tended to sink so deep that it proved impossible to steer them, so they simply ploughed straight on

A famous picture taken in Peronne selected to show the stowed unditching beam, the vast number of spare petrol cans carried on the roof and the end of a towing cable at the back. It is also worth remarking how often tanks are seen with no obvious markings on display at all.





CAMOUFLAGE

In a landscape that was composed almost entirely of churned-up soil, there was little scope for any of the more exotic forms of camouflage on the Mark IV. The tanks had been painted a medium brown since early 1917, and although some patterned schemes have been identified from photographs, they are rare and show no signs of standardization. In any case, by the time various identification numbers had been painted on and crews had adorned their tanks with individual decorations or unit symbols, camouflage was a bit of a waste of time. Indeed there is a case for suggesting that in action it was better for tanks to be seen. Lying up prior to a battle was another matter and each tank was provided with a large camouflage net, suited to the area in which they were to hide. In October 1917, for example, 4th Battalion records that it was issued with nets that represented brick rubble, rather than trees or vegetation, in order to lie up in ruined villages. Special brackets on top of the cab and at the rear were standard fittings on the Mark IV to support these nets.

Protecting the tanks from aerial observation was another problem. The tanks could be adequately camouflaged at rest using the nets, although the Germans made careful study of the shadows that a tank would cast. On the move it was more difficult since the tracks, as they passed around the top of the hull, caught the light on a sunny day where they were worn silver and almost flashed up signals to the aircraft. One attempt to counter this by fitting an extensive frame and net arrangement over the top must have been more trouble than it was ever worth. In any case there was also a requirement for tanks to be seen and reported by friendly aircraft, so most of them had large unit numbers painted in white on top of the cab for that purpose.

MARK IV (FEMALE) TANK D51 *DEBORAH* (2ND LIEUTENANT F.G. HEAP), 12TH COMPANY, 12th SECTION, D BATTALION, TANK CORPS, CAMBRAI, 20 NOVEMBER 1917

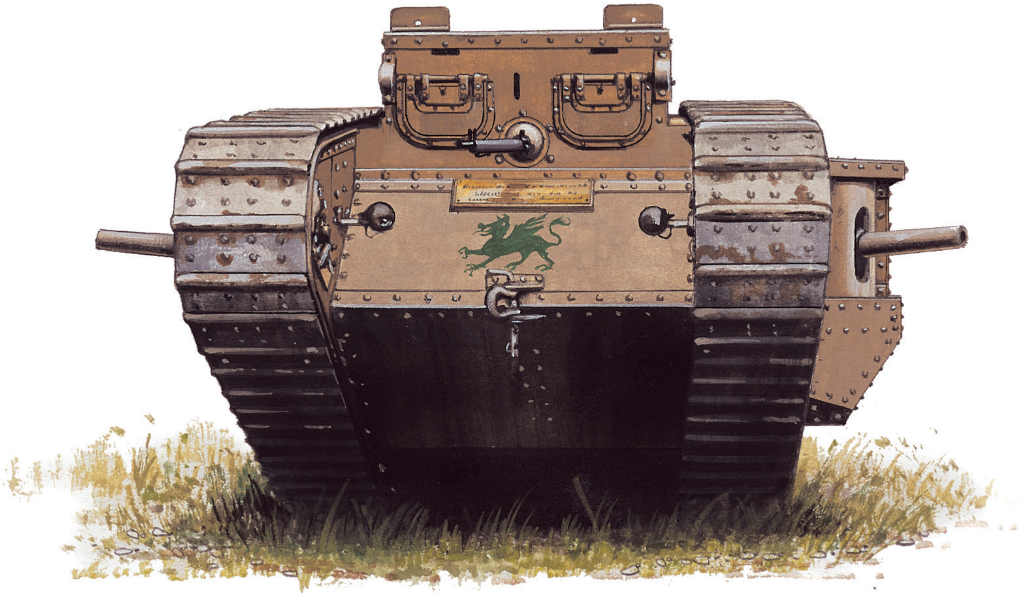
Deborah is shown above in the typical khaki brown finish. The number D51 would be repeated on the rear of the fuel tank and on top of the cab roof. The name would be painted across the front.

The bulky fascine is in the launching position above the cab and this area has been partly sectioned to show how this was done. The fascine itself is tightly bound with chains and chains are also used to secure it to the towing bracket on the nose. It is held at the rear by a quick-release arrangement, activated by a red lever situated at the back of the cab. The fascine would be released just as the tank began to tilt forward into the trench. Until the fascine is dropped the tank is unable to make use of its unditching equipment.

Deborah was knocked out by German artillery in Flesqueries and buried during battlefield clearance at the end of the war. It was rediscovered and recovered by local historian Philippe Gorczynski in 1997 and is now on display in the village. (Art by Tony Bryan, © Osprey Publishing)

until a shell hole or other obstacle stopped them. At this point most of the weight was being taken by the underbelly of the tank while the tracks flailed around impotently.

The first expedient for handling a ditched tank was to search the area around the stricken vehicle for anything that could be packed under the tracks to give a grip.



MARK IV (MALE) TANK *FAN-TAN*, 6TH BATTALION, TANK CORPS

The donation of a tank with funds raised in Malaya subsequently attracted a good deal of mythology, although in fact it seems to have been managed almost entirely in Britain. The tank is shown here as it was when posing for a set of publicity photographs. There is a brass plate on the front with details of the donation, a fierce and colourful dragon beneath it and an eye painted on each side near the front. This reflected the oriental practice of painting eyes on boats so that they could 'see' where they were going.

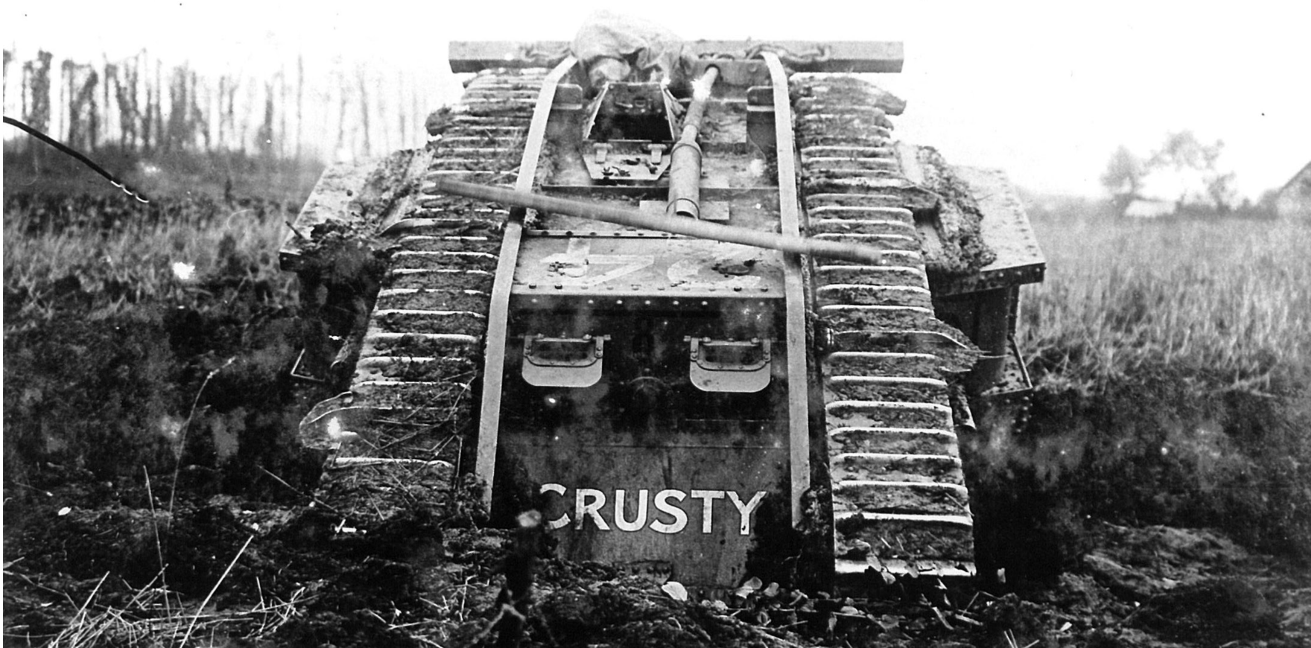
At this display the tank was also fitted with three unusual air-cooled machine guns, apparently designed by Vickers, although they were never adopted for tanks. Tank No. 2341 was built by Fosters of Lincoln and was issued to F (later 6th) Battalion. It served as *Fly-Paper* under 2nd Lieutenant J.M. Oke, but was renamed *Fan-Tan* by the time of Cambrai, where it was commanded by Lieutenant H.A. Aldridge. It remained with the battalion until June 1918 when the unit converted to Whippets. It was hoped to present the tank to Malaya after the war, but there is no evidence that this ever happened. (Art by Tony Bryan, © Osprey Publishing)

Some tanks were provided with a device called the 'torpedo spud' that could be attached to a track at such times, but this was soon eclipsed by a far more effective device known as the unditching beam. It is believed to have been devised by Philip Johnson, then serving as an engineer officer at Erin. The beam itself was a solid piece of oak, protected by steel plates on two sides, which could be chained to the tracks and dragged around underneath the tank if it became ditched, in order to provide a firm purchase. Since the beam weighed in the region of half a ton it was not easy to manhandle, so each tank was provided with a set of rails running from front to back along the top of the tank and high enough to clear the cab and other fittings. When not required the beam was carried on top of the tank and secured to these rails. Once the tank was stuck two crew members, each with pockets full of spanners, would climb onto the tank and attach the beam to the tracks by means of a sort of chain-and-stirrup arrangement. The driver would then put the tank in gear, lock the differential and use the beam to get out of the hole. On very bad ground some drivers kept going with the beam attached until they were safely onto firmer ground. Then the tank stopped, with the beam back on its rails, to be stowed for the next time. Bearing in mind that this was often done under fire, and sometimes more than once in a single action, the role of the volunteers who attached it is not to be envied. As a corollary to this it should be noted that once the unditching gear design was worked out a requirement was issued for the equipment to be manufactured in Britain. Since nobody would take on the job, pleading pressure of other work, Central Workshops in France made all the unditching gear for the Mark IV tanks, so it is reasonably safe to say that any Mark IV tank seen with the rails fitted had experienced service in France at one time or another.

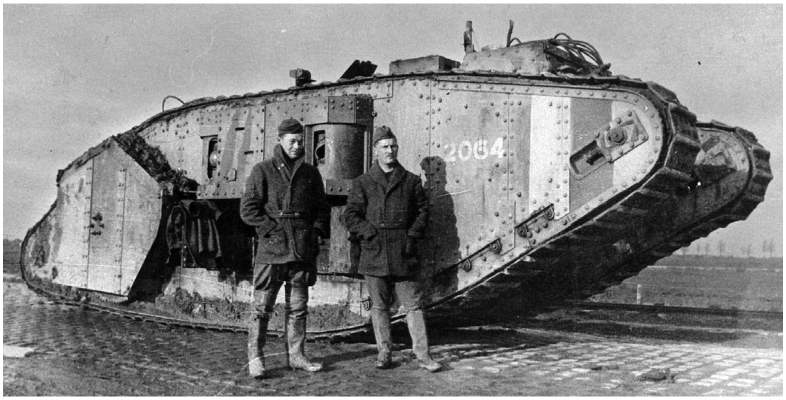
On 27 July 1917 the Heavy Branch became the Tank Corps and thus severed its tenuous connection with the Machine Gun Corps. A new cap badge was adopted, bearing the motto Fear Naught, and as time went by other details were introduced to make the Tank Corps more distinctive in its own right. All of this took place to the sound of the guns, for on 16 July 1917 a huge bombardment began from a total of 3,091 guns firing along an 11-mile front. Various matters conspired to cause this barrage to continue for the next 15 days, after which the battle known as Third Ypres began, as did the rain.

The Tank Corps had allocated 216 fighting tanks to the battle, shared between the six battalions then in France. Each battalion also had six supply tanks, issued on a scale of two per company, which at this time had been modified from redundant Mark I and Mark II machines. Third Ypres would have been a tragic battle whether tanks were involved or not, but it would be wrong to suggest, as some accounts do, that they contributed nothing. The tanks shared the misery, learned a great deal and just now and then produced an impressive performance. Even so, in the main, it was a test of stamina for officers and men to launch their tanks upon a sea of mud and struggle forwards in the most appalling conditions in an effort to assist the infantry, who suffered far more.

It is from this period that another useful aid, known as the ashplant, can be dated. In place of the usual officer's cane Tank Corps officers took to carrying a longer stick, approximately ½in in diameter, which they used to test the ground. The simple test was that if it required two hands to push the stick 12–18in into the ground that equated to a bearing pressure of 20psi, if just one hand was required to achieve the same effect that would represent 10psi, but if the stick went right in up to the handle the ground could bear no more than 5psi. Even sunk to its belly plates a Mark IV tank exerted a pressure of 11.6psi. Of course, the deeper a tank sank into the ground



The 3rd Battalion tank *Crusty* provides us with a good view of the top. The bar above the cab seems to have broken loose from somewhere, but it is possible to see the number 24 (painted on top of the cab), the covers for the periscope holes, the silencer and roof hatch, which is open. Notice also the rear stowage position of the unditching beam and the mud that accumulates on top of the sponsons.



Undoubtedly the best picture yet seen of one of the Operation *Hush* winching tanks still in use in 1918, presumably in a recovery role. The winch, driven off the starboard side secondary gears and tucked behind the extra panel of armour, is believed to have been supplied by John Fowler & Company of Leeds, which specialized in cable plough equipment.

the length of track in contact increased; typically, standing on firm ground, the length of track in contact was 4ft 7in, but in motion on softer ground this would increase to 11ft. There is some evidence to suggest that the experience of operating tanks in this mud introduced a change in the driving technique. Afterwards it seems the normal practice was to drive with the differential locked.

The first day of Third Ypres resulted in the ditching of more than 70 tanks and the loss of a substantial number to enemy artillery where ground conditions obliged the vehicles to follow one another along a particular route. It also led to the near-suicidal practice by some officers of walking ahead of their tanks under fire, prodding the ground with their ashplants in order to keep them on a safe course. Yet in all of this there were highlights. On 19 August 1917, nine tanks took part in what appeared to be a desperate mission to capture the village of St Julien. Not that there was much to capture: St Julien was little more than a map reference where, in places, the mud was stained with the colour of bricks from demolished houses. Now the only buildings were reinforced concrete strongpoints which were the Flanders equivalent to the trenches of the Somme, since to dig trenches here was pointless unless one was looking for water.

Moving in line ahead and sticking to what remained of the roads, the tanks crossed a stream and drove into the village. Two bogged in the stream, but the remainder all attacked their objectives and by bold handling literally outgunned the strongpoints one after another. At the end five tanks were able to turn around and drive back to the British lines. The attack was launched without any preliminary bombardment but was shielded by a smoke screen, and the village was captured at a total cost of 15 casualties.

That success notwithstanding, the offensive dragged on until the beginning of November. Tanks were used on numerous occasions, but it was a costly offensive that never achieved its ultimate objective and nearly did for the tanks. As early as 3 August the Tank Corps' tactical expert, Major J.F.C. Fuller, declared that the tank's part in the Ypres offensive was over. He argued for a new attack on ground more suitable to tanks, but others drew a different conclusion. Many officers, some of high rank, deduced that if tanks could not operate in the prevailing conditions then they were useless.

OPERATION *HUSH*

Third Ypres was not just some pointless offensive, launched into the blue – it had important objectives. One was to drive German forces from the Flanders coast and capture the U-boat bases that were causing so much trouble to Allied shipping. In typically British tradition a scheme was hatched to launch an amphibious operation as a supplement to the main offensive. This was daring enough under the circumstances, but made more so by a decision to include some tanks in the attacking force, less than a year since they had first been used in action.

A special force was raised that included infantry, artillery and nine tanks. Secret training areas were prepared and special craft built. The scheme involved employing six monitors (shallow-draught, big-gun warships) lashed together in pairs, which would propel three long pontoons, each 550ft from stem to stern, up to the beach. Three tanks would be stationed at the head of each pontoon and they would lead the forces ashore. The problem was that this low-lying coast was protected by a high sea wall, shaped in places like a curling wave before it breaks, complete with a protruding crest.

After a great deal of experimental work a scheme was approved to overcome this obstacle. The first tanks ashore would each propel a wedge-shaped ramp up the wall until it lodged under the lip of the crest. The tank would then detach the ramp and clamber over it, using its guns to keep heads down once it reached the top. Since the wall was likely to be slippery with seaweed and slime, special spikes were fitted to the tracks so that the tanks could grip, but even this was not the end of the innovation. The sea wall would also be an obstacle to the various wheeled elements of the force, so some of the female tanks were equipped with powered winches, driven from the secondary gears on the right side. Having reached the top of the wall these tanks would position themselves facing inland and draw up the guns, transport and sledges laden with stores.

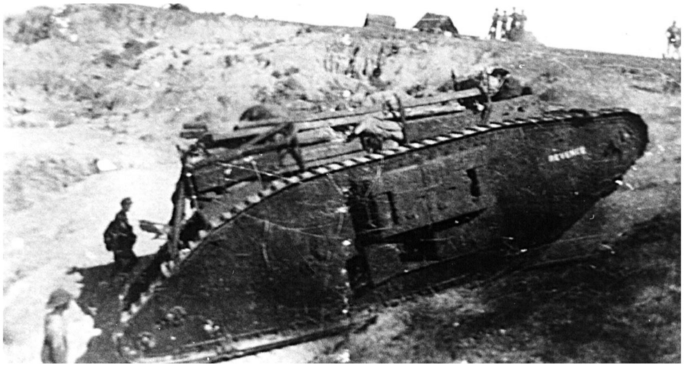
Whether Operation *Hush* would have worked or not is debatable, but it was a brave conception and highly innovative. In the end it was a wash-out due to the failure of the main offensive, but the winch tanks proved extremely useful later for recovery work.

WITH THE EGYPTIAN EXPEDITIONARY FORCE

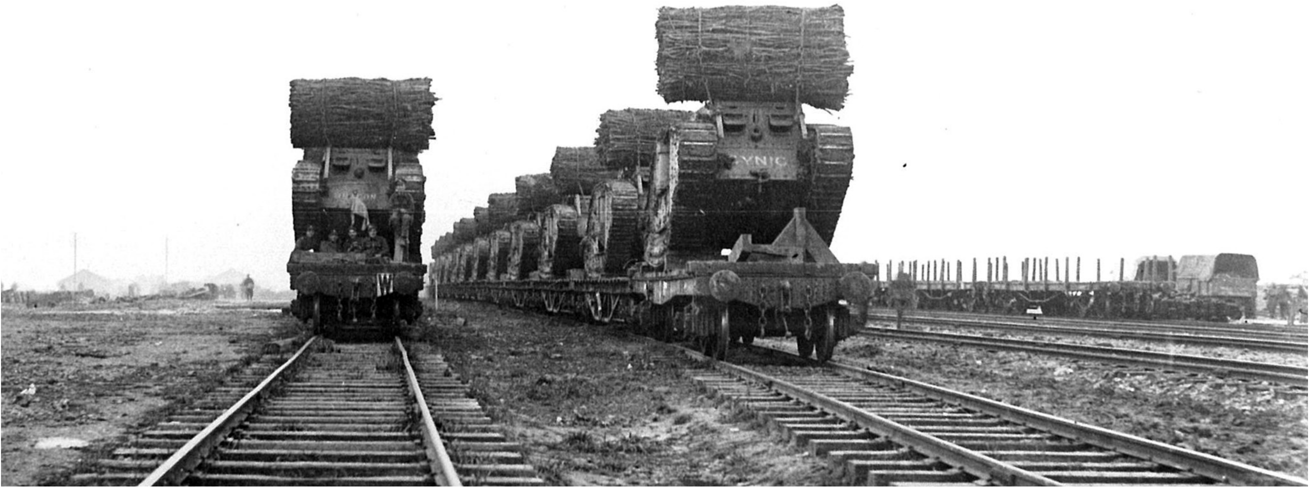
The first tank operation in the Middle East, at the second battle of Gaza (see Chapter 2), resulted in the loss of three tanks, which were replaced in due course by three of the Mark IV type, two male and one female. The battle known as Third Gaza was scheduled to begin on 1 November 1917 and, despite their numbers, the tanks were destined to play a significant part.

The preparations for battle were made far better than on the previous occasion. There was time for adequate reconnaissance and pre-battle cooperation with the infantry, although the six tanks earmarked to lead the attack had far too many objectives to complete and the two held in reserve were overloaded with stores to deliver before they could clear the decks for action. The battle actually began by moonlight, which normally spelled disaster for tanks, but here it was so bright that there were no problems. Even so, three tanks of the first wave became ditched and had to be abandoned, while the reserve tanks got into trouble because of stores piled on top catching fire due to their proximity to the exhaust. None of the tanks arrived in time to do any fighting; in the end it did not matter since the entire battle was well planned and well executed to the extent that within three days the defeated Turkish Army pulled out.

Once the battle was over the three abandoned tanks were recovered and restored, but they would not see action again. The nature of the terrain and the speed of the subsequent advance saw



Poor as it is, this photograph of Mark IV female *Revenge* has been selected to illustrate how tanks at Third Gaza were seriously overloaded with stores that had to be delivered to a series of posts before the tank could actually go into action.



Mark IV tanks of D (on the left) and C battalions at Plateau railhead on the eve of Cambrai, with their fascines in place. It says a lot for the diligence of the Royal Flying Corps that this huge concentration of machines was never spotted from the air by the Germans, otherwise it would have given the whole game away.

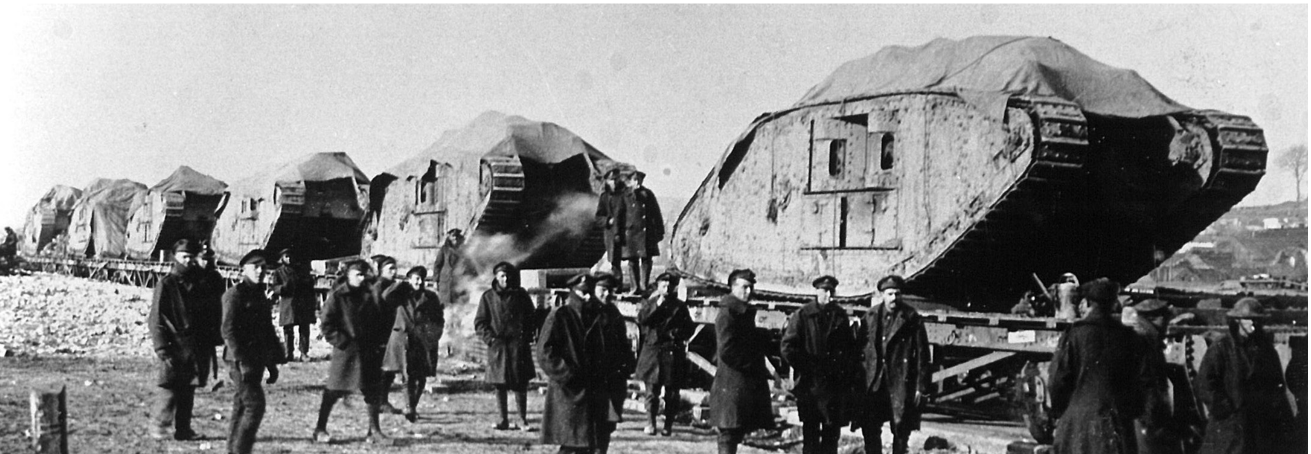
them excluded from future combat and in due course Major Norman Nutt's detachment returned home.

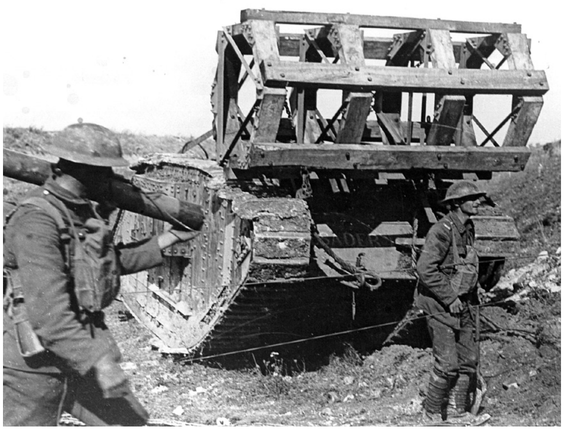
THE BATTLE OF CAMBRAI

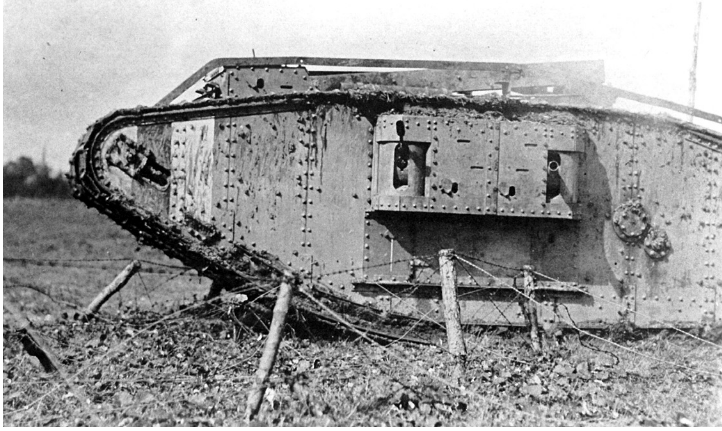
Cambrai and the Mark IV tank are inseparable. Not that the tanks could have functioned without the aid of other arms, but they were the main focal point of the battle and it is worth remembering that Cambrai had to be structured around them, not the other way around. In other words, it was the limitations of the Mark IV tank – its speed, range and manoeuvrability – as much as its potential that dictated the pace of things. It is also worth recording that from October 1917 male tanks were issued with case shot, which proved to be an effective anti-infantry round. An official stowage list states that each male tank was to carry 184 shells and 20 rounds of case.

There is little purpose in covering Cambrai in detail here; it has been picked over in print innumerable times. Since we must concentrate on the tanks, then it would be best to notice what was special about them in this battle and how they were adapted for the occasion. However, first a small matter of figures. The tank battalions were shared, unequally, between three brigades. All nine battalions of the Tank Corps then in France took part and each battalion had, theoretically, 42 Mark IV tanks. Of these, in most cases, 24 took part in the initial attack with 12 more to follow through to the second objective and six held in reserve. This gives us a total of 378 fighting tanks. In addition there were 54 supply tanks and nine wireless tanks divided between the three tank brigades, while among the fighting tanks already recorded 32 were equipped as wire cutters, two as light bridge carriers for the cavalry and one loaded with spare reels of telephone line since this material, liberally strewn all over the field,

Fins, near Gouzeaucourt on the southern edge of the Cambrai battlefield, was a railhead for the start of the battle. Here it serves the same function after the battle as tanks are loaded up and sheeted down for their journey back to winter quarters.







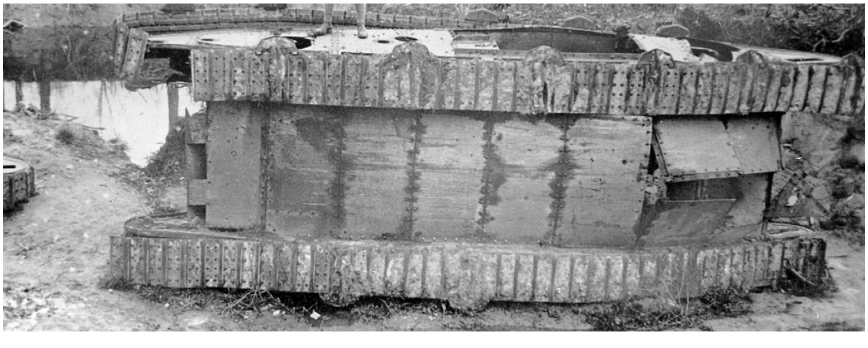
Above The crib, essentially a lighter, reusable fascine, was rarely seen on Mark IV tanks, but this female with a broken track is carrying one during the attack on the Hindenburg Line on 27 September 1918 in support of the Canadians.

Above Right This Mark IV female, probably training with American infantry, demonstrates its ability to deal with barbed-wire entanglements, but note that in the front of the sponson the Lewis gun has been replaced by a rifle fitted with a grenade-launching cup.

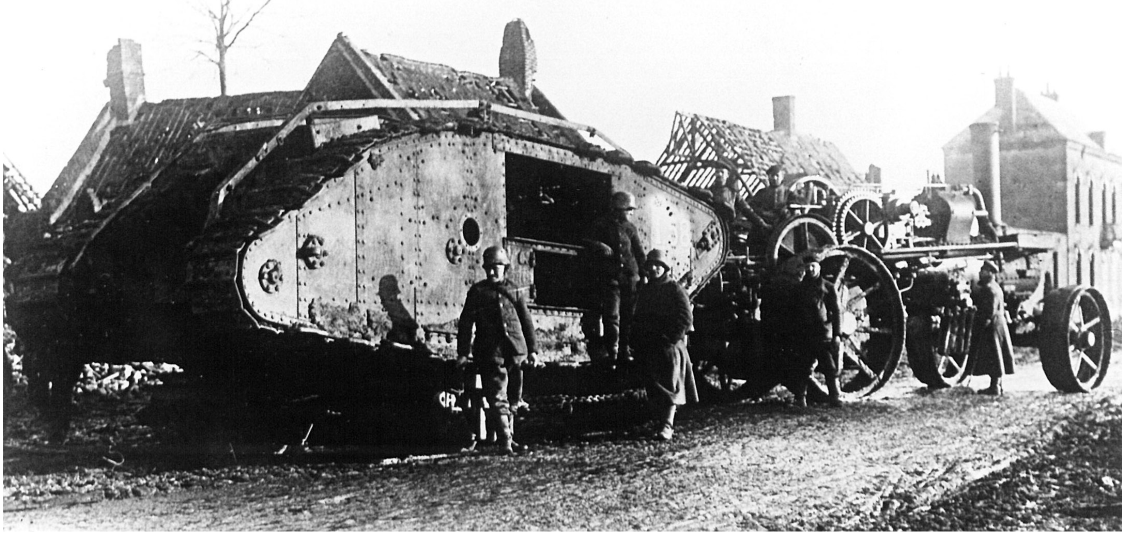
was often broken (usually by the tanks themselves) or 'borrowed' for unofficial purposes. All of these tanks had to be delivered to the area by rail, a process that involved nine trains each day for four days, each train carrying 12 tanks. The railhead was a vast marshalling yard known as 'Plateau', where as each train arrived it was unloaded so that tanks could be fitted with their fascines, then reloaded and despatched to advanced railheads nearer to the frontline.

Zero Hour was at 6.20am on 20 November 1917 and simultaneously with a brief but violent artillery barrage, the first wave of tanks moved off in the misty, pre-dawn darkness. Near the centre of the line a male tank with the improbable name of *Hilda* (Lieutenant T.H. Leach commanding) carried the Tank Corps commander, Brigadier General Hugh Elles, flying the red, brown and green Tank Corps colours from the top hatch. It is by such actions that l'esprit de corps is fostered. Cambrai was not a success in the long run, but its initial impact was remarkable, so much so that Cambrai Day continues to be celebrated by the Royal Tank Regiment. And it is probably indicative that the greatest reverse, when a battery of 7.7cm guns trained in the anti-tank role knocked out 16 British tanks on the Flesquieres Ridge, has somehow become part of the British legend. It is also worth pointing out, to maintain a sense of balance, that the published histories of most British infantry divisions that took part in the battle hardly mention tanks at all.

Each one of these tanks had a 1½-ton fascine perched on top of its cab and Cambrai was the only occasion when this device was used by tanks in this way. A quick glance at the statistics would probably help to explain why. In its normal form, as a modest bundle of sticks, the fascine is probably as old as warfare. Teams of sappers would carry them forward and throw them into ditches or trenches that might hold up the advance.



One of two tanks knocked out in Bourlon Wood, Cambrai, on 23 November 1917. This one has suffered a major internal explosion that has bulged out the floor and broken open the front end. Of technical interest, since it is not normally seen, is the way the spaced armour behind the petrol tank is attached at the bottom.

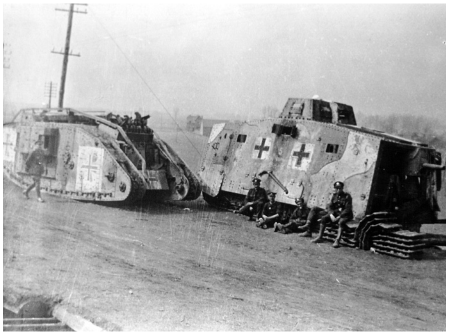


This rather dark picture shows a stripped female machine being recovered by German troops in the aftermath of Cambrai using a large traction engine and two sets of rollers, linked by chain, to support the otherwise immobile tank. This tank is believed to be 158, which caught fire in Bourlon village on 24 November 1917 and had to be abandoned.

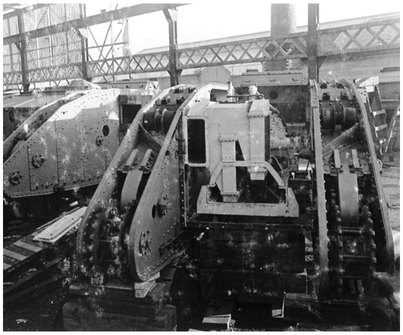
Indeed they had been used in this way to fill the Steenbeek creek during the attack on St Julien. By comparison the Cambrai fascines were monsters, each one composed of 75 normal fascines bundled together and then squeezed tight by loops of chain hauled by two tanks pulling in opposite directions. All told some 400 tons of light timber was extracted from the Forest of Crécy, which resulted in 22,000 small fascines, sufficient for about 300 tanks. But it did not end there.

Techniques had to be devised for lifting the fascines onto the tanks and then releasing them at the right time. Once again Central Workshops had to turn to and manufacture the fittings, which included securing chains, a quick-release mechanism and a lever inside the tank to operate it. The drill was that as each tank approached its allotted section of the extra-wide Hindenburg Line trenches, the driver would hold the tank on the brake as it began to tip forward while the commander reached behind him and jerked the special lever to release the fascine into the trench, whereupon the tank drove across it. Where they were used they appear to have worked perfectly well, but they were a one-shot commodity – they could not be recovered and used again.

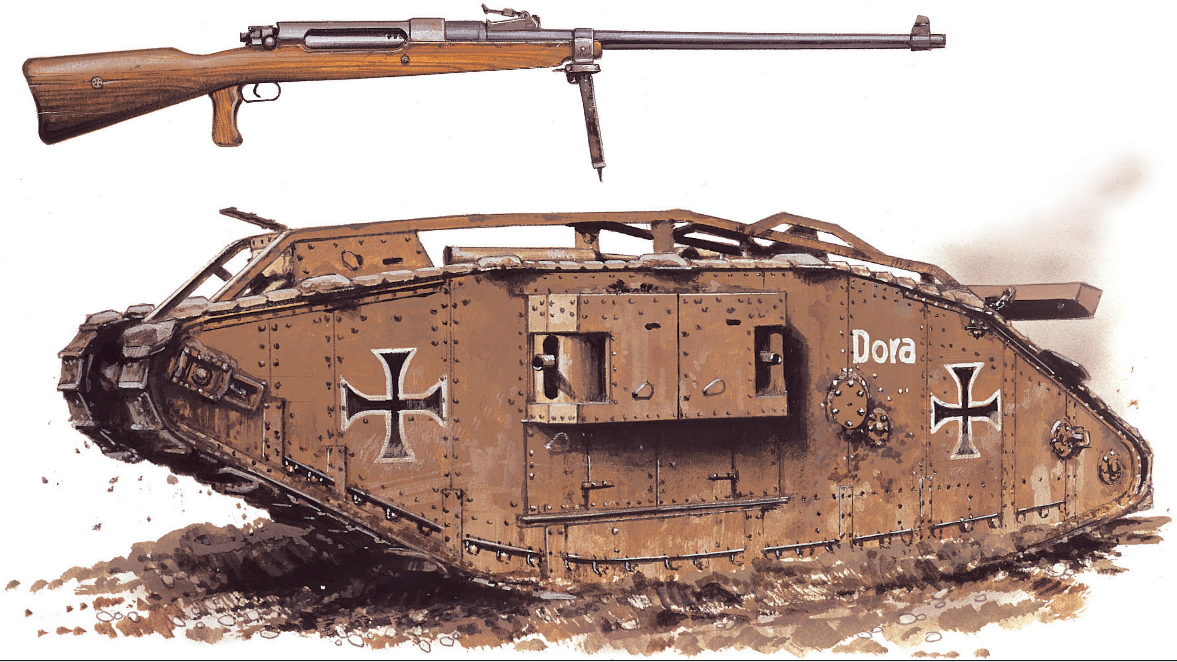
In theory the wire-cutting tanks would be considered next in importance to the fascines. The British High Command had high hopes for Cambrai and visualized a total breakthrough of the German defence system through which they intended to send mounted cavalry. Unlike infantry, however, the cavalry could not negotiate wire entanglements, even flattened entanglements, at all. Thus on certain sections of the front tanks would pass through the wire in pairs, dragging huge grapnels that tore through the entanglements and, as the towing tanks peeled off right and left, ripped the wire clean out of the ground. It worked so well that not a trace of wire remained



Far Left A very rare view of an A7V and captured Mark IV together, both in a semi-dismantled state, probably at Charleroi after their capture by the British at the end of the war. The A7V is believed to be 503; the Mark IV has not been identified.



Left From the rear are visible the new-style radiators, the drive sprockets, plus the skid rails and flanged rollers that carried the top run of the tracks. The tank on the left is in a more advanced state of construction.



MARK IV (FEMALE) BEUTEPANZER *DORA*, BAYERISCHER ARMEE-KRAFTWAGEN-PARK 20, CHARLEROI, BELGIUM, 1918

Dora (original identity unknown) seems to have been used for training and demonstration purposes before being issued to a combat battalion. It appears to have retained the original British khaki brown colour, although all British markings have been painted out and replaced by iron crosses and a new name. The only other modification carried out by the Germans looks to be a hinged flap or hatch in the cab roof.

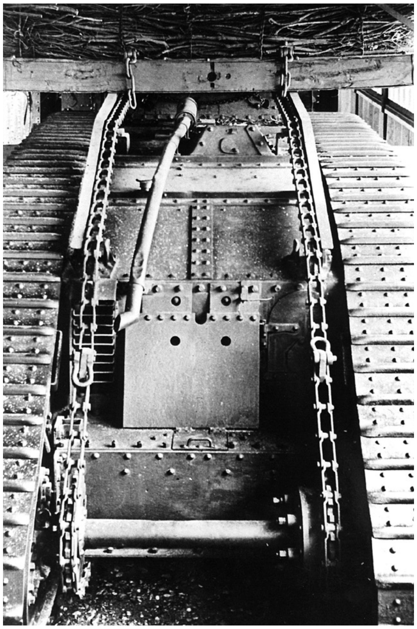
Most captured tanks were later finished in more exotic colour schemes; all were named and usually carried a circle device, in a colour appropriate to the battalion, on each side, but the style of national markings seems to have varied considerably. The provision of suitable machine guns for female tanks turned out to be a problem until a means was found to modify the original Lewis guns to chamber and fire German ammunition. *Dora*'s fate is not clear. The name does not appear in any subsequent battalion records, so it may well be that the tank was renamed at some point. One trustworthy source suggests that *Dora* carried the number 101 and served with Battalion 11 and may later have been rechristened *Lotte* and issued to Battalion 14. The T-Gewehr anti-tank rifle also illustrated was primarily an infantry weapon, but some were carried in tanks. It fired a 13mm round and had a fierce recoil, but the effective range was little more than 100 yards. (Art by Tony Bryan, © Osprey Publishing)

in the gaps, or so they say. In the event this was all to no purpose. For reasons that need not concern us here, the cavalry was unable to take advantage of the opportunity, so its contribution to the battle was limited.

Supply tanks had already proved their value. Those at Cambrai certainly included some of the earlier types along with others based upon redundant Gun Carrier machines, but the Mark IV versions were something of a special case. They had simple, unarmoured sponsons based on the shape of the original male type, but the interior was more scientifically arranged to carry more equipment and in a tidier fashion. Wire mesh screens were erected to keep the stores from falling upon the engine or the crew, but the difficulty, as far as the latter were concerned, was that this prevented them from moving around inside the tank. Thus the gearsmen, having climbed in through the sponson doors, were more or less trapped near the secondary gears while the driver and commander could only clamber in or out through a new hatch fitted in the cab roof. In addition to the load they could carry inside and on top, the supply tanks were also equipped to tow trains of store sledges, similar to those designed for Operation *Hush*, and these became yet another burden on the overworked staff at Central Workshops, since it was not possible to have them made in Britain.

Regarding the wireless tanks, it is not clear whether, at this stage of the war, they were of the Mark IV type or redundant veterans of 1916. None of the surviving photographs, mostly of knocked-out tanks, appear to show them, although it is known that the one and only cable-carrying tank was a Mark IV of G Battalion named *Galway*.

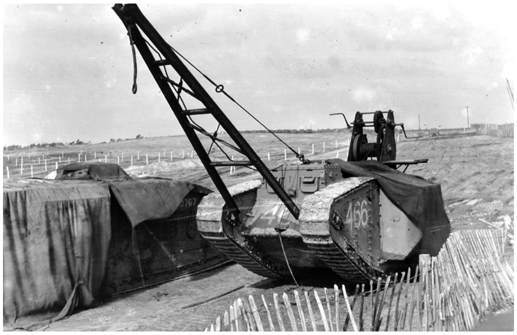
Cambrai failed in the long run due to a lack of adequate reserves on the part of the British and increasingly stubborn German resistance, including their use of mobile anti-aircraft guns in the anti-tank role. The German counter-attack at the end of the month enabled them to clear many broken down and abandoned tanks from the area, either for their own use or as a source for spare parts. Bearing in mind that only a few of the abandoned tanks were runners, the system arranged for their recovery was extremely ingenious, although it would only work on good ground and preferably near roads.



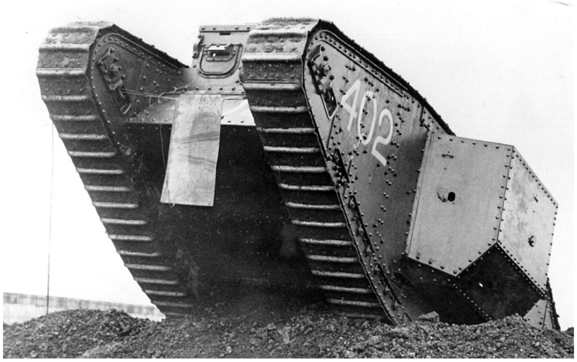
Photographed at Bovington, this rear view of a tank with chain-operated unditching beam equipment shows how the chains were powered by a special cross-shaft and extra sprockets at the rear. Note that a fascine is also fitted, but whether that was also activated by the chain gear is not clear.

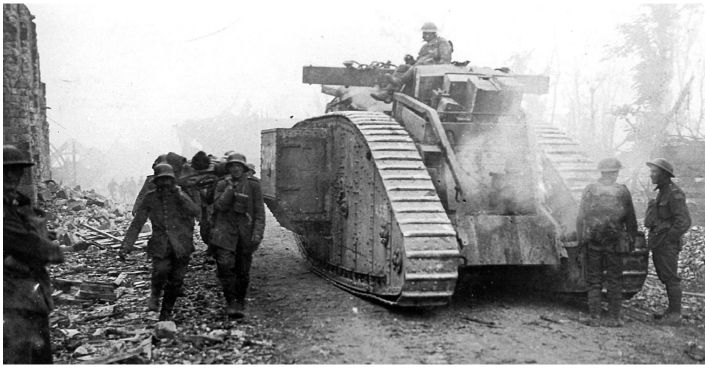
The Germans designed a system of rollers, each approximately the width of a tank and attached to a sub-frame. Each tank was raised on four heavy-duty jacks while two of these rollers were pushed underneath and the whole ensemble drawn to the railhead by a steam traction engine. The recovered tank was parked astride the railway, raised again while the rollers were towed away and a railway wagon shunted underneath instead.

One tank, in working condition, was taken to Berlin and demonstrated for the Kaiser, while the remainder were moved to a factory near Charleroi in occupied Belgium, where a repair facility was established. Precise figures are not available, but it appears that of some 50 tanks dragged off the Cambrai battlefield around 30 were restored to operational condition. The female tanks were first in service since, following difficulties with the 08 Pattern Maxim machine gun, the majority retained their Lewis guns, suitably modified to fire German ammunition. The male tanks presented a greater problem. The majority had already been stripped of their 57mm guns as they lay on the battlefield and it was some time before they could be rearmed with 57mm Nordenfelt guns taken from captured Belgian stocks. There is some photographic evidence to show that the 13mm anti-tank rifle, the so-called T-Gewehr, could be fired from a female sponson and at least one tank had the front machine-gun mounting adapted to accept this weapon. For some reason the Germans elected to cram a crew of 12 into their Mark IV tanks, although one photograph purports to show a tank modified to make it possible to operate the secondary gears from the front seats. There is no indication given of how it worked and, to



Number 466 was the unusual combination of a training tank with supply sponsons. It was used at Bovington as a crane tank with a standard jib. The big winch at the back operates the hoist instead of the usual chain system.





Above This is the Mark IV supply tank used for aircraft-to-tank wireless communication trials at Biggin Hill towards the end of the war. The panel suspended by string between the front horns is presumably something to do with the receiving process.

Above Right This view of a Mark IV supply tank was taken in Hourges on the second day of the battle of Amiens, 9 August 1918. It appears to be waiting to go forward, well laden with stores. Meanwhile, German prisoners are bringing in a stretcher case.

judge from the photograph, the equipment looks too flimsy for the job and may have been nothing more than a mechanical indicator for the gearsmen. The Germans are also reported to have fitted a hatch in the cab roof of their captured tanks.

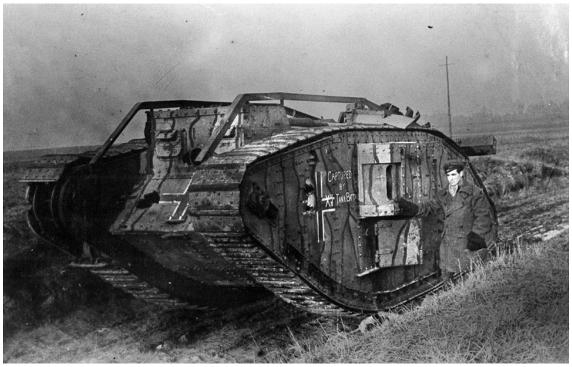
The Germans created a tank training area at St Amand, close by Charleroi, and raised up to six detachments to operate captured tanks alongside their own home-grown design, the A7V. The Mark IV Beutepanzers not only outnumbered A7Vs in German service, they generally proved to be more reliable and better suited to the conditions. However, there were many delays in the restoration process, which seems to have had quite a low priority, and, although they saw some service, the German tanks appeared too late to achieve very much, were not always used in the most advantageous way and were never available in sufficient numbers.

MECHANICAL IMPROVEMENTS

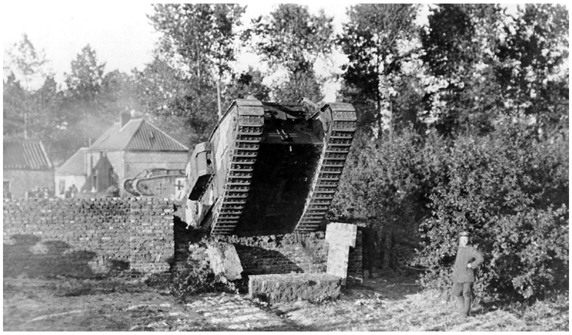
The feeling that the Mark I to Mark IV tanks were underpowered was quite common and, for the long term, a new, more powerful engine was being designed. In the meantime, the Royal Naval Air Service provided an aero engine expert to see what might be done with the Daimler. Lieutenant W.O. Bentley, whose name would later become synonymous with large sports cars, had a particular interest in the use of aluminium pistons to improve performance and when these were applied to the Daimler, in conjunction with a new carburettor, they increased the compression ratio from 4.2:1 to 4.75:1 and raised the power from 105 to 125hp. This modification was applied to many of the later production tanks, but in practice it had a severe drawback. In careless hands the extra power stressed the secondary gear shafts, which buckled under the strain. The majority of 125hp tanks, therefore, entered service as supply tanks, which did not suffer such hard usage.

Another significant change, introduced part way through production, concerned the radiator. To begin with tanks were fitted with the original Daimler envelope type, derived from the Foster-Daimler tractor and used in the earlier tanks. These were replaced in later machines by a pair of ‘gilled tube’ radiators which gave better air and water circulation and therefore better cooling. In either case the radiator was cooled by a belt-driven fan that drew in air from the body of the tank, thus alleviating the ghastly conditions to some extent. Having passed through the radiator air was ejected through a louvred panel at the back.

While the fascines used at Cambrai certainly worked, they were a clumsy solution to the problem, being heavy, labour-intensive and a one-shot trick since they could



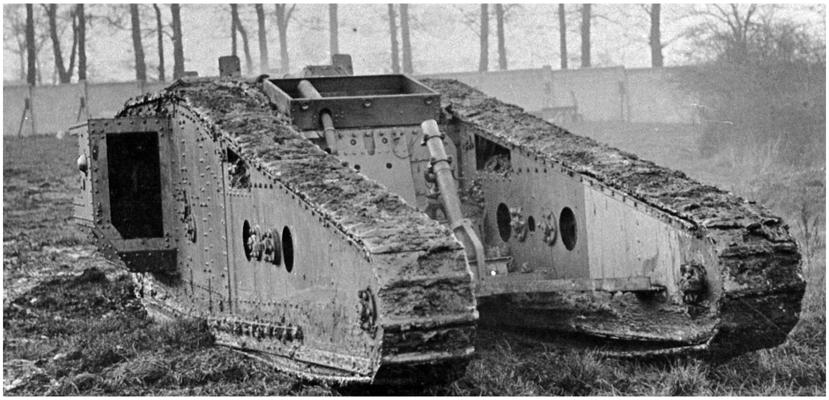
This unusual photograph shows a Mark IV female Beutepanzer that may have been a victim of the fighting on 8 October 1918. The legend on the side claims that it was captured by 12th Battalion and the damage to the side and front, not to mention the broken track, suggests that it has been in a fight. If so it would be one of the German 15th Battalion tanks that participated in the second tank-versus-tank action of the war.



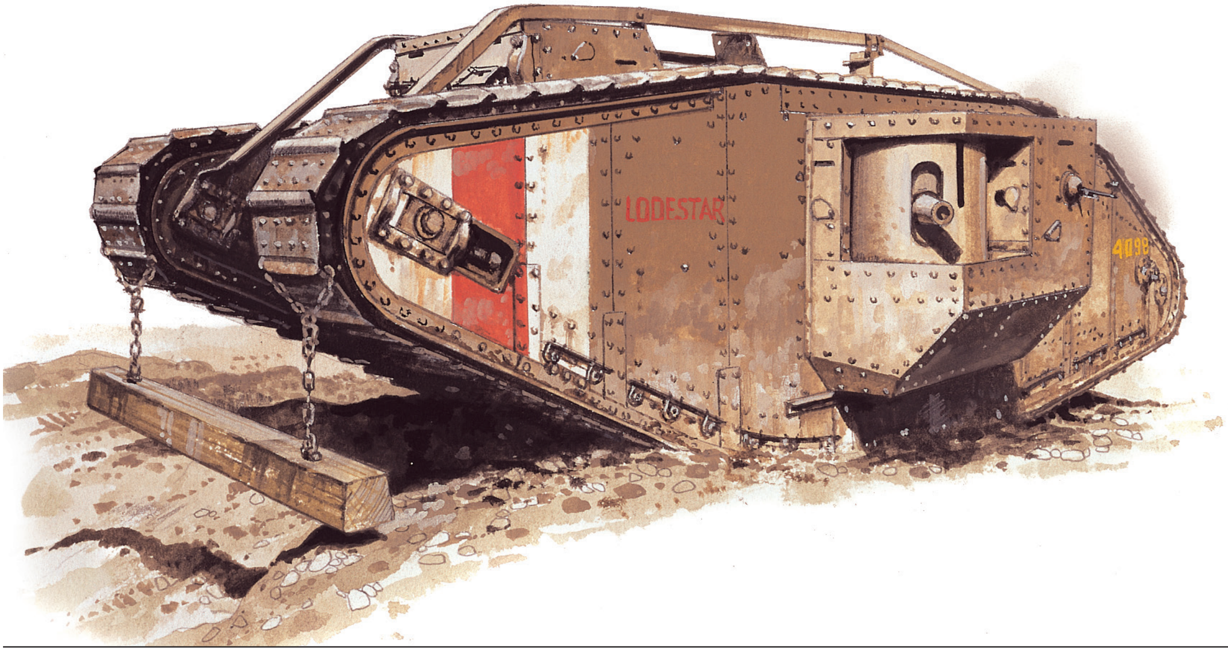
German crews train on captured Mark IV tanks at St Amand in Belgium. The Germans made far more use of interesting camouflage patterns than did the Tank Corps, but then, for practical purposes, were obliged to adorn their tanks with large black crosses.

not be recovered and used again. One alternative to the problem of wider trenches was to stretch the tank, although this would raise problems connected with steering. Fosters came up with a device known as the 'Tadpole Tail', which extended the track frames rearwards but, most of the time at least, remained clear of the ground. The attachment lengthened the tank by 9ft and required 28 more track plates on each side and an extension of the chain drive to the rear sprocket. As is often the case, the modified tank worked adequately on trials, but did not stand up so well to continued use, the tail being too light and flexible to remain rigid enough. A substantial number of these tails were made and shipped to France, but there is no evidence to suggest that they were employed on service tanks. The original modified Mark IV, a male machine, was used for various trials, including sledge-towing and the mounting of a Newton mortar in the gap between the rear frames and set to fire forwards, over the tank. The Tadpole Tail was also fitted experimentally to the Mark V tank, but it does not appear to have been popular with Central Workshops personnel in France, who came up with a solution of their own. This is more normally associated with the Mark V, but there are some references that suggest that at an early stage in the process a Mark IV was adapted by having an extra 6ft section of hull inserted just to the rear of the gun sponson aperture, which effectively extended the body of the tank.

A number of Mark IV tanks had, by 1917, joined the earlier models at Bovington Camp for use as training machines. Most were identical to the fighting tanks in France, although they normally lacked the unditching beam and support rails and displayed a large, three-digit number probably in white on both sides and sometimes at the front and rear as well. Bovington also carried



The Mark IV male Tadpole Tail, posed at Dollis Hill to display its rear extensions and a 6in mortar mounted to fire over the tank. Tests were also carried out on firing mortars from inside male sponsons.



MARK IV (MALE) TANK *LODESTAR*, 12TH BATTALION, TANK CORPS, FRANCE 1918

Only two Tank Corps battalions, the 7th and 12th, retained Mark IV tanks right through until the end of the war. Both battalions supplied tanks for a rare night-time attack on the village of Gomiecourt on 23 August 1918 and later in operations over the old ground at Cambrai during the attack on the Hindenburg Line. By this time all British tanks (including those operated by the 301st US Battalion) bore the white/red/white recognition stripes. These were normally painted on the front horns as shown, often on top of the cab and sometimes at the back as well. The Germans had salvaged so many British tanks from the original Cambrai battlefield that it was agreed to mark 'friendly' ones in this way. *Lodestar* survives in the Musée Royale de l'Armee in Brussels.

The unditching beam was invented in France and, in the case of Mark IV tanks, also fitted there by Tank Corps Central Workshops. It was carried on special rails running along the top of the hull and normally stowed near the back where it was easier to reach with some degree of protection for the crew. It was attached to each track by a form of stirrup that slid underneath but had to be bolted in place, a risky business under fire. (Art by Tony Bryan, © Osprey Publishing)

out various experiments on its own initiative, many of which dealt with methods of cutting barbed wire or finding other ways of carrying infantry, although there is no certainty that this particularly involved Mark IV machines. One trial that certainly did was a curious arrangement in which an unditching beam, supported by the usual rails, was carried around the tank on two loops of heavy-duty Renolds chain that seems to have been driven via a cross-shaft at the rear, linked to the final drive. It is not entirely clear how, or indeed whether, it worked. Given the stresses and strains involved the device does not look strong enough, but it would have reduced the risks associated with attaching an unditching beam under fire and it appears to have survived to the end of the war.

A portable tank crane, in fact nothing more than a jib and chain hoist that could be fitted to the nose of any heavy tank, was commonly seen on Mark IV tanks in the salvage role. They were particularly useful in workshops, but Bovington went one better and mounted a massive, gear-operated winch on the back of one Mark IV supply tank, which was evidently used on a regular basis around the workshops towards the end of the war.

In an increasingly technological war the concept of cooperation between aircraft and tanks was explored. (Cooperation between the Royal Flying Corps (RFC) and the Royal Artillery was already well established.) Tanks carried an identification number painted on top of the cab for reporting purposes, but any direct communication with aircraft was hampered by the poor visibility from inside the tanks and the engine noise. The two forces devised a system of signalling from plane to tank using long, paddle-like arms protruding from the sides of an aircraft in various combinations to signify a limited range of messages. How anyone was expected to see this from inside a tank, never mind which tank was being addressed or how it responded, is unclear. In fact Captain Bernard Rice of 8 Squadron, RFC, reckoned that tanks were almost impossible to spot from the air unless you followed the tracks they had made.

Clearly, radio communication between aircraft and tank would be most desirable, but here the technology was severely limited. The RFC already had a lightweight transmitting set, but there was nothing equivalent for the tanks and in any case it would be defeated in a tank by the volume of noise. To test the ground–air radio a Mark IV male training tank was used, in conjunction with a BE2c, at the Biggin Hill experimental establishment, but the results do not appear to have been very successful. Even so, aircraft played a significant role in support of tanks during the Cambrai battle. Four RFC squadrons were earmarked for the ground-attack role and proved to be particularly effective when engaging enemy artillery batteries that were themselves deployed for anti-tank work.

MORE POWER

Still in pursuit of improved performance over and above what W.O. Bentley had provided, Albert Stern tried to persuade Daimler to come up with something better. They turned the offer down pleading pressure of work, so, early in January 1917, Stern approached a young engineer named Harry Ricardo to see what he could offer. The story of the Ricardo engine belongs more properly to the saga of the Mark V tank in Chapter 4, but it is also mentioned here for what might have been. Ricardo's brief included the requirement that his new engine should fit into the same location as the Daimler, although more height was permitted, so it was entirely possible to install the Ricardo engine into the Mark IV, and this was certainly done. Lists of experimental machines issued by the Mechanical Warfare Department at the end of the war included some Mark IVs described as having Ricardo engines, although nothing is said about transmissions.

Presumably if the 125hp Daimler was too powerful for the secondary gear shafts of the Mark IV, the 150hp Ricardo was even worse, but the installations may only have been for trials purposes and test crews presumably handled them with more care. Ultimately, of course, the plan was to operate the Ricardo engine in conjunction with Wilson's epicyclic transmission. If the full conversion had been carried out on the Mark IV, as it must have been for test purposes, the resulting production machines would have been designated Mark IVA. In November 1918 a list was compiled of the number of surviving Mark IV tanks, most of which were being held as reserves in France, and the plan was to fit these with the Wilson transmission while retaining the Daimler engine. This was never done because there was no need, but it is not clear whether the original Daimler gearbox was to be replaced as well.

The obvious advantages of the Wilson transmission notwithstanding, other options for mechanical improvement were still being considered in 1917. Apart from heat problems, the Williams-Janney hydraulic steering system had shown promise at Oldbury and an Edinburgh firm, Brown Brothers, was charged with perfecting it. They first applied it to a Mark IV tank, which may well have been one of the 11 dedicated experimental machines listed earlier. As a result an improved type, known as the Mark VII, was developed to prototype stage (see Chapter 6).

1918: THE FINAL BATTLES

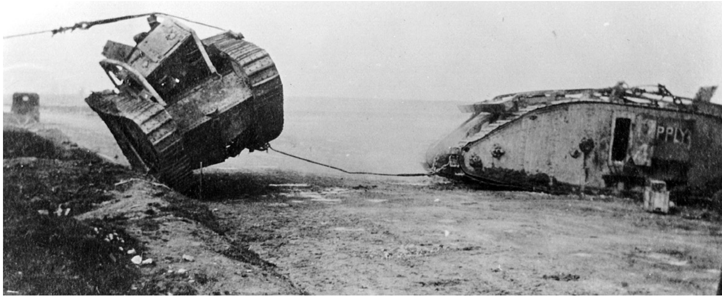
In January 1918 the tank battalions were instructed to alter their designations from letters to numbers, A Battalion becoming 1st, B 2nd and so on. The New Year also witnessed a gradual eclipse of the supremacy of the Mark IV with the appearance of improved tanks from British factories and a potent rival in the German ranks. The Mark IV had plenty of fight left in it – this it showed right to the end – but the nature of the war was changing to one of more fluid conditions that the plodding Mark IV, with its cumbersome driving system, simply could not match.

This development is probably exemplified by the events of March–May 1918, the period of the two great German counter-attacks. Largely relieved of their commitments in the east by the Russian Revolution, the German High Command poured thousands more men into the Western Front, intent on forcing a decision before vast new American armies could arrive to checkmate them.

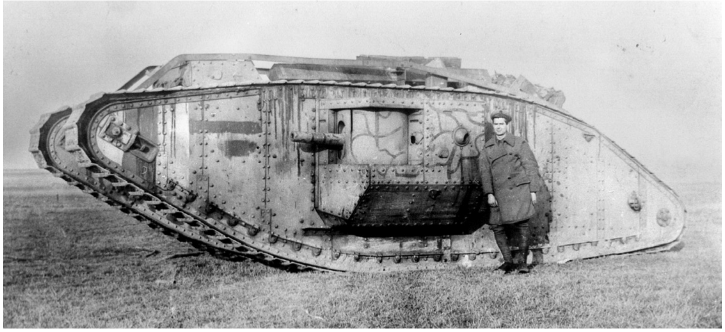
The Allies were well aware that such an attack was impending and, beyond strengthening the traditional defences, there was the question of what to do with the tanks. It was impossible to predict just where the attacks might fall. Therefore, in addition to keeping the bulk of the armour well back in reserve, and ultimately employing the crews as infantry Lewis gun teams, a number of tanks were retained in locations close to the frontline to be employed as what Brigadier General Hugh Elles described as 'Savage Rabbits'. The idea was that as the German attack surged forwards these tanks would throw off their camouflage and dash out to attack them. In this role the tanks had some successes, but there were too many handicaps. For a start, Mark IV tanks were simply not designed to dash anywhere, but in addition German tactics involved swerving away from any serious resistance and looking for a weaker spot somewhere else. Many tanks were lost when they became cut off behind the advancing German line.

Towards the end of April the Germans had accumulated sufficient tanks of their own, both the A7V and some captured Mark IVs, to mount an attack on the Somme front. One of three A7V tanks, emerging from the town of Villers-Bretonneux, encountered three Mark IVs of 1st (A) Battalion which were patrolling the British line near the village of Cachy. Two of the British tanks, both females, were engaged by the

A number of towns and cities in France with strong Tank Corps associations also received tanks. Cambrai was an obvious choice, and to mark the importance of the occasion the city's legendary figures Martin et Martine have come down from their places on the Hotel de Ville to greet the tank.



Clearing the battlefield at the end of the war, a Mark IV supply tank assists in righting a badly damaged machine that looks as if it suffered a major internal explosion. Notice what appears to be a very large hatch on the cab roof of the wreck.



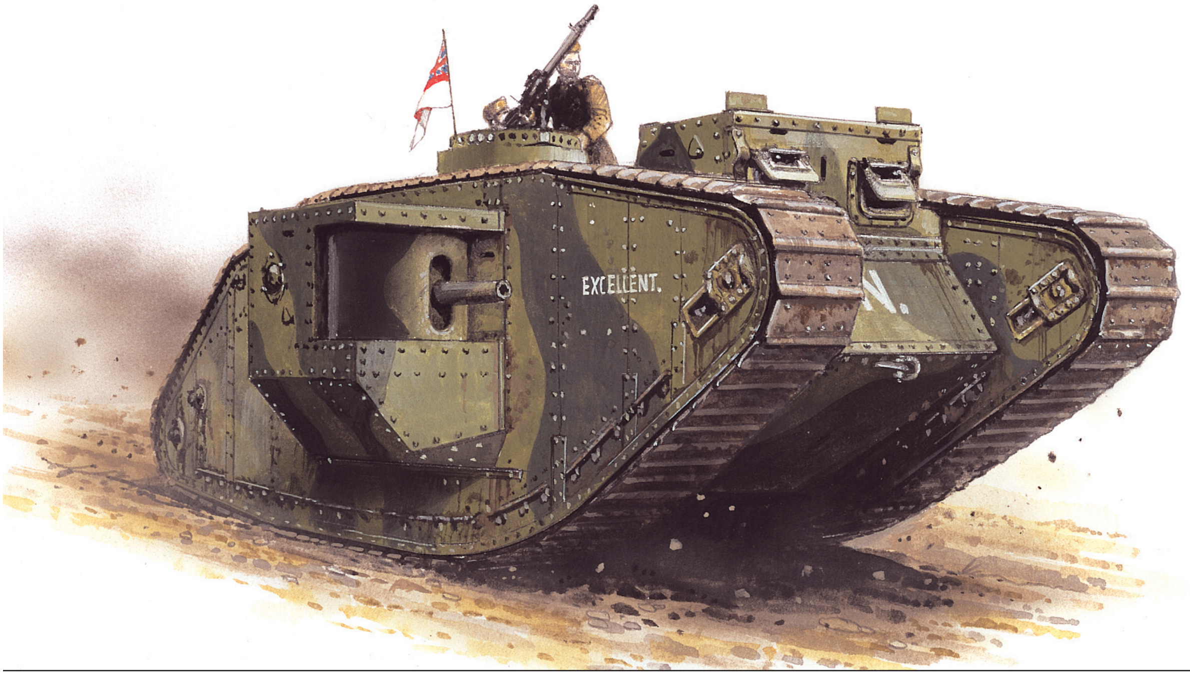
A difficult picture to explain: a Mark IV male with red and white stripes and an odd pattern of markings on the sponson. A large baulk of timber, which may be an unditching beam, is stowed lengthwise on top and a soldier in a curious mixture of uniforms is leaning against it. At the front a name and number appear to have been painted out.

German tank and forced to withdraw with serious damage. Meanwhile, the British male was manoeuvring for a good position and prepared to take on the A7V. One unfortunate feature of all British tanks of World War I was the total lack of any sprung suspension. This deficiency not only gave the crew a very harsh ride, it also transmitted vibrations to every part of the tank including the sighting telescope, which was rendered useless. The commander of tank A1, 2nd Lieutenant Frank Mitchell, had the sense to halt and his gunner managed to put a number of rounds through the German A7V No. 561 *Nixe* (Lieutenant Wilhelm Biltz) of Assault Tank Detachment 2. Historically, this first tank-versus-tank fight is a significant although pyrrhic victory. Biltz abandoned his tank but later managed to retrieve it and withdraw some distance before it seized up. Frank Mitchell stayed in command of the field, but his tank was soon hit by German artillery, disabled and abandoned.

By the summer of 1918 the majority of battalions had re-equipped with the new Mark V tank or were training to do so. Thus when the great battle of Amiens opened on 8 August the only Mark IVs to be seen would have been supply tanks. There were, however, two Tank Corps battalions, the 7th and 12th, which retained their Mark IVs and used them in some of the later battles. Fortunately the tanks were applied with a good deal of common sense. For example, at Bapaume on 21 August each type of tank was used to its best advantage. Thus the two Mark IV battalions led the way through the thinly held German outpost line and on to the second objective, where the more powerful Mark V and Mark V* machines took over. The Germans had taken up the idea of thinning out their frontline and keeping their main strength farther back in the hope that the attackers, by the time they reached the deeper lines, would have run out of steam. At Bapaume their main line of resistance was the embanked railway line that linked Albert with Arras. This was heavily defended, but the new tanks were relatively fresh, despite running the gauntlet of a heavy German barrage, and broke through to create an opportunity for the lighter, faster Whippet tanks (see Chapter 7) to undertake the third stage.

At Moeuvres on 27 September, 16 Mark IVs from 7th Battalion operated with the Canadian Corps in an attack that involved crossing the dry bed of the unfinished Canal du Nord which, in places, had a bank some 9ft high. All but one of the tanks, some of which had fought over the same ground at Cambrai nearly a year earlier, managed to climb the bank and roll into action. Even so, as a foretaste of future problems one of the tanks was disabled by a German mine buried in a roadway.

The last battle involving Mark IV tanks seems to have been towards the end of Second Cambrai on 8 October, when 12th Battalion had the unusual experience of confronting four Mark IV tanks in German hands near Niergnies. Accounts of the action are confusing and contradictory, but it may be that male tank L16 put one of the Beutepanzers out of action. The German tanks, or their supporting artillery, exacted some revenge and knocked out at least three of the British Mark IVs, including L16, while the crew of L8 used a captured German gun to smash another of the German tanks. When another Mark IV, albeit a female, rolled up from the British side, the remaining German tanks departed.



MARK IV (MALE) TANK *EXCELLENT*, WHALE ISLAND, PORTSMOUTH, 1940

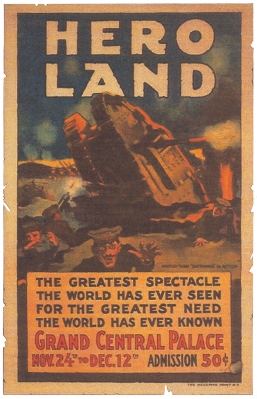
In addition to those tanks donated to municipalities around Britain as a reward for fund raising, some were supplied to establishments that had assisted with the development of tanks and the Tank Corps. HMS *Excellent*, the Royal Naval Gunnery School in Portsmouth Harbour, naturally received a male tank for assisting with the training of tank gunners and the evidence suggests that it was a training tank from Bovington. During the invasion scare period in the summer of 1940, a young officer from Whale Island restored the tank to running order, fitted it with a special Lewis gun mounting on top and prepared it for further action. It was finished in the two-tone green colour scheme favoured for tanks at this time, christened *Excellent* and to make a point had the letters 'R.N.' in white across the front and a large White Ensign flying at the back. Legend has it that it made one 'run ashore', damaged a private car and was quickly withdrawn.

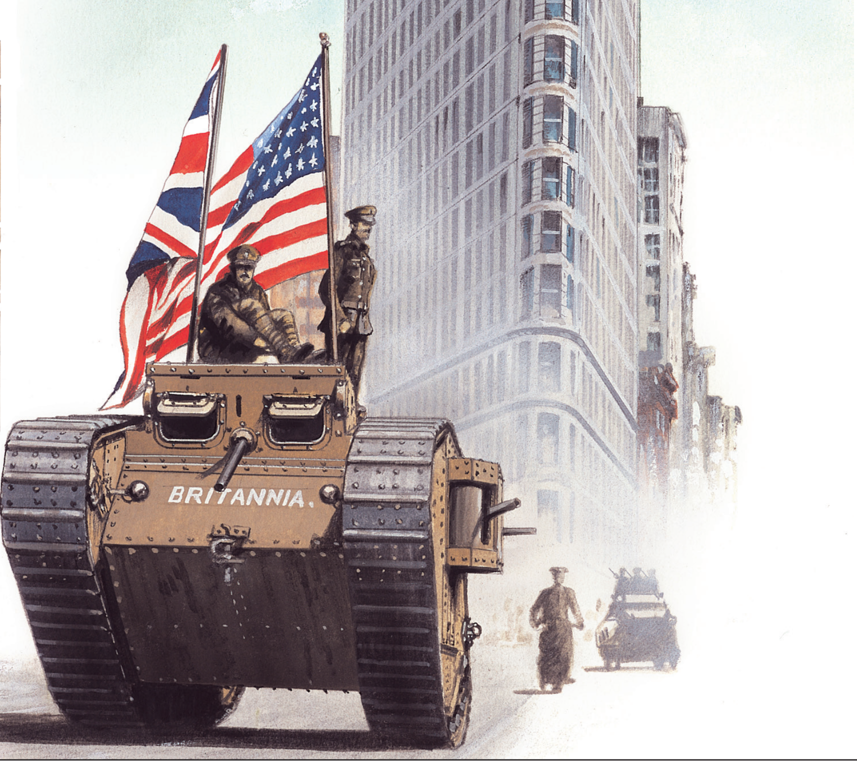
This tank, fully restored to its original condition, is now a prized exhibit at the Tank Museum and a star of the BBC TV series *Soldiers of 1983*. (Art by Tony Bryan, © Osprey Publishing)

That was it as far as the fighting Mark IV tanks were concerned, but others may have remained in service as supply tanks. The last tank action of the war took place on 4 November 1918 in the area around the Mormal Forest. It was here that three supply tanks, which could easily have been Mark IVs, on a mission to deliver bridge-building material to the village of Landrecies, saw action. Approaching the site they discovered German troops still in occupation but decided to attack anyway, relying upon their appearance, and a single machine gun each. At the cost of one tank disabled, they captured a number of troops and chased the rest away. A week later the fighting came to an end.

POST-WAR

Almost coinciding with the battle of Cambrai, a pair of Mark IV tanks took part in the Lord Mayor's Show in the City of London in November 1917. Their popularity was so marked that a tank was also incorporated into an exhibition of weapons displayed in Trafalgar Square around the same time. To capitalize on the tanks' popularity, the National War Savings Committee organized a programme of travelling


HERO LAND
THE GREATEST SPECTACLE THE WORLD HAS EVER SEEN FOR THE GREATEST NEED THE WORLD HAS EVER KNOWN
GRAND CENTRAL PALACE
NOV. 24TH TO DEC. 12TH ADMISSION 50¢



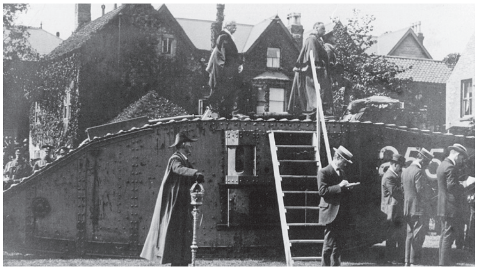
MARK IV (FEMALE) TANK *BRITANNIA*, NEW YORK CITY, 25 OCTOBER 1917

Tanks were despatched to a number of countries for publicity purposes, among which Australia, Canada and the United States have been identified. The American tank *Britannia* was shipped over in the summer of 1917 and in production terms must have been an early machine. It went with a specially selected British crew and took part in a number of events.

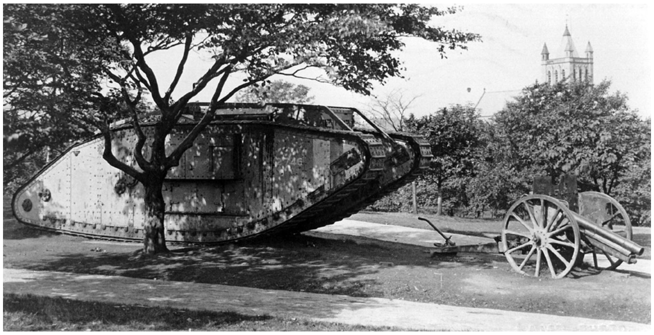
On 25 October 1917 it formed part of a parade through New York City, escorted by armoured cars of the New York National Guard. This painting is based upon a spectacular photograph of *Britannia* rolling down Fifth Avenue, flying the Union Jack and the Stars and Stripes, with the distinctive shape of the famous 'Flat Iron' building in the background. Heroland was a very American affair, a spectacular piece of showmanship intended to entertain the public, while educating them about the war. (Art by Tony Bryan, © Osprey Publishing)

tanks that toured England and Wales selling War Bonds, and subsequently Victory Bonds when the fighting was over. A similar scheme operated in Scotland. Impressive sums were raised and, to judge from the timetable, a lot of hard work was involved. Tanks travelled by rail and at every location the skeleton crew had to reinstate the sponsons (all five touring tanks were male machines), drive into town and spend a few hours acting as a platform for speakers and as a sales point for the Bonds. There appear to have been times when an individual tank managed two adjacent towns in a single day which must also have increased the burden for the overworked railways.

In 1919, with the agreement of the Tank Corps, the National War Savings Committee decided to offer redundant tanks to any community that had raised more than a certain sum per head of population. Some 265 communities in England and Wales were nominated, along with an uncertain number in Scotland. The majority accepted and delivery was arranged from Bovington.



Mansfield in Nottinghamshire receives its War Bond tank – female training machine 255 – on 21 May 1919 and the town council is out in force, as are the gentlemen of the press. The officer standing next to the mayor seems to be speaking, while the rest of the crew are lined up in front.



The Mark IV female presented to Barnsley, and displayed in Locke Park, is a genuine veteran; the unditching beam rails and red and white stripes are a giveaway. Though no proof has been found as yet, some evidence suggests that captured enemy artillery was donated to towns with Victoria Cross recipients, so the German 77mm gun in front of the tank might indicate this.

Female tanks were preferred since, without machine guns, they had no offensive potential for unruly elements in society bent on revolution. In each case the tank was delivered by rail from Bovington with a scratch crew and driven to its final resting place. Here the young officer gave an account of the particular tank's war record – almost always fictitious – disabled it mechanically and set off for home.

Some locations, mostly cities such as Coventry or Lincoln that were associated with the production of tanks, received male machines, but others were distributed to locations for more obvious reasons. For example, the Royal Naval Gunnery School HMS *Excellent* on Whale Island, Portsmouth, received a male tank in recognition of its help training tank gunners in the early days, and various communities in France were also recipients. Cambrai is a good example: having enjoyed close associations with the Tank Corps during the war, it also received Mark IVs. There were more than enough to spare.

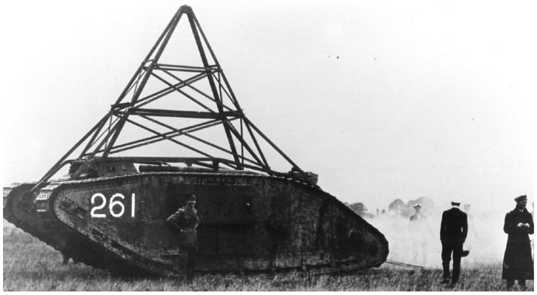
The Mark IV was obsolete even before the war ended; it would have no place in the post-war army. For one thing, a considerable cloud hung over the future of the tank as a weapon, but in any case immediate requirements, limited as they were, could easily be met by the vastly superior Mark V machines.

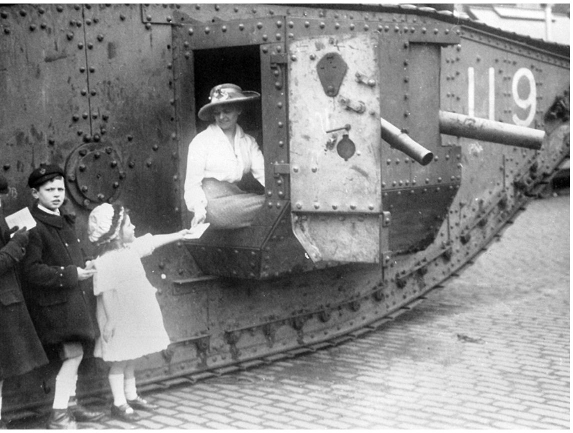
One Mark IV is known to have served in Ireland, while a dozen were supplied to the United States, although it is not clear what the Americans wanted them for. Others were donated as examples to certain Commonwealth countries and overseas Dominions such as Australia and Canada. Another was supplied to Japan, but whether as a gesture of Allied gratitude or as a sample for future development it is not clear. One even ended up as a seaside attraction at Southend-on-Sea. Operated by a consortium of retired Tank Corps officers, and stripped of its sponsons, it had seats inside for those who wished to be deafened and a wooden upper deck for passengers who preferred fresh sea air. It appears to have done at least one season running up and down the beach, but it would have been a maintenance nightmare and it is doubtful if it ever returned a worthwhile profit to its proprietors.

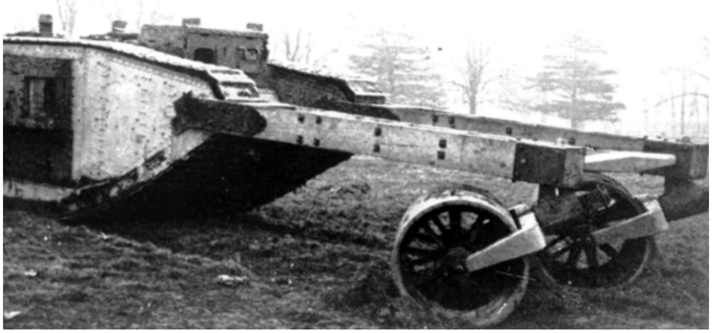
Although it was in its infancy in 1918, the anti-tank mine was beginning to prove a serious threat and various German types were described in the Tank Corps' *Weekly Tank Notes*, the majority of which were based on buried artillery shells detonated by pressure. As a counter-measure, the obvious method of setting them off ahead of an approaching tank was some sort of heavy roller device and a Mark IV female was used for one such experiment at Christchurch. Two hefty wooden beams extended forwards from the track horns. At the end of each was a complete front roller drum from a commercial steam road roller. It must have been very hard work for the tank, but the vehicle was completed too late to make any difference.

The vast majority of war surplus tanks were simply shipped back to Bovington and scrapped, although a significant number still remained on the Western Front, too damaged to move but too much of a

The female training tank fitted with a special tower to handle airships at the Royal Naval Air Station at Pulham in Norfolk. As the war ended the station petitioned the Tank Board for a Mark V machine, which was no doubt regarded as easier to handle for this difficult task, but this request was turned down.







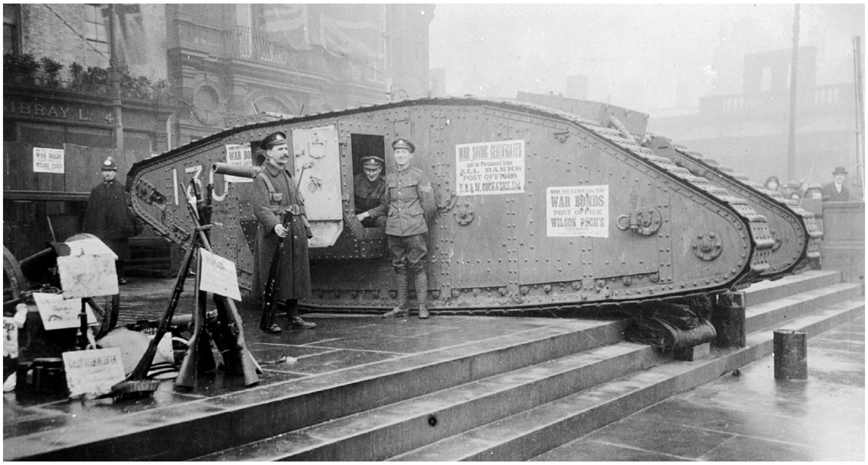
nuisance to leave behind. Thus the Tank Corps raised a special salvage detachment which, for many months after the end of hostilities, worked steadily across the battlefields, blowing up wrecks where it was safe to do so or, in a few cases, burying them where it was not.

Most of the captured tanks used by the Germans were recaptured, although two female Mark IVs were operated by Freikorps forces in Berlin in 1919 in an attempt to overawe dissidents. These were then handed over to the Allied Control Commission, although another female machine, sent to Daimler at Stuttgart as a pattern for German designs, appeared briefly in 1920 before it, too, was repossessed.

That might have been it as far as the Mark IV was concerned had it not been for the threatened German invasion of 1940. Serving at Whale Island at this time Sub-Lieutenant Menhinnick, RN, looked over an old male tank and wondered if it might not be put back into working order for local defence. Missing parts were taken from another Mark IV then located on Southsea Common and the old machine was soon running again. A special cupola with a machine gun for anti-aircraft use was added on top of the hull and the tank repainted in contemporary military colours. On one occasion it ventured across to the mainland, using the causeway that is exposed at low tide, and here, according to legend, it collided with a private car and further use was banned. Perhaps it is fitting that it should be the Royal Navy that last used a World War I tank. After all, they had been responsible for its introduction.

Above This is the only known photograph of the Mark IV anti-mine roller, which is believed to have been completed at Christchurch at the end of the war. The rolls are clearly taken from a couple of steamrollers and are pivoted like castors. Why the tank is painted as it is, in contrast to the sponson, is not clear.

Above left A nicely constructed photograph of Tank 119 *Julian* on one of its sales tours. The young lady in the sponson will stamp the customers' cards while payment will be completed at a nearby bank or post office. We are also treated to a useful view of the interior of a male sponson door.



Tank 130 *Nelson* guarded by a sentry and a police constable along with two of its crew on a War Bond sales tour. It is shown here with a number of other weapons. Unfortunately the location has not yet been identified.

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CHAPTER 4

THE MARK V TANK

Most writers and historians commenting on the introduction of the Mark V tank in 1918 suggest that this was an entirely new design that gave the British Tank Corps a considerable edge in the final year of World War I. This is quite true; it was new and it did make a tremendous difference to what the Tank Corps was able to achieve in 1918.

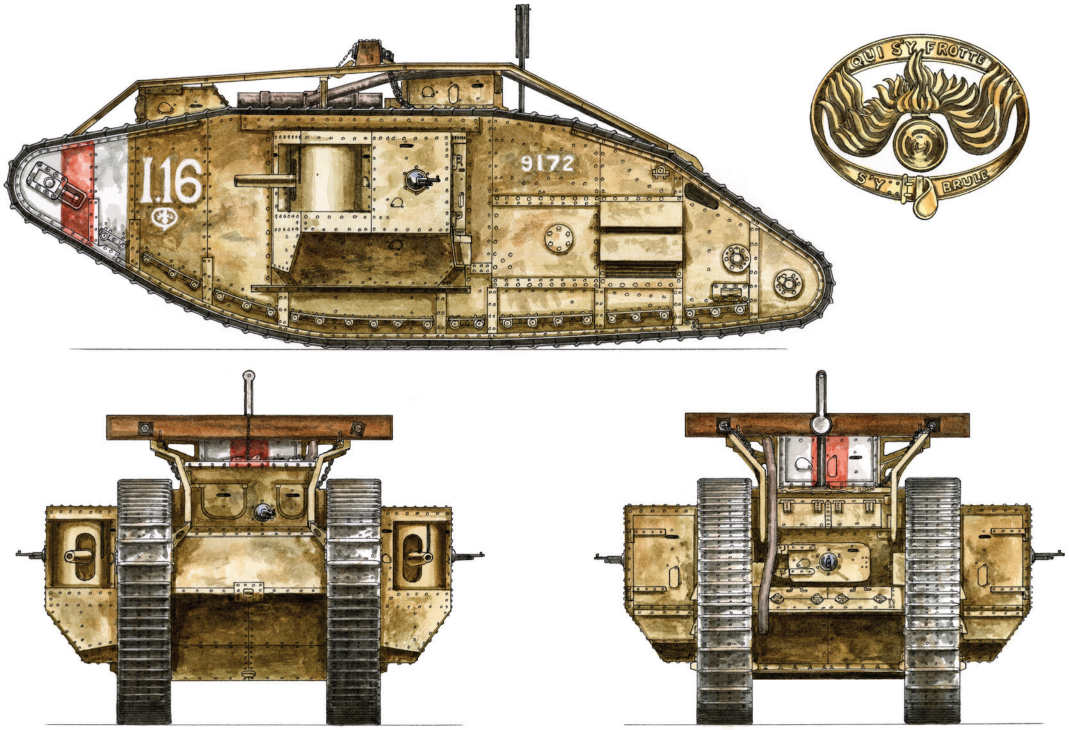
On the other hand, since there never is anything entirely new, the Mark V can also be seen as part of an evolutionary process and many of its most significant features were originally developed for its predecessor, the Mark IV. Indeed one is tempted to suggest that many people, even those with a serious interest in World War I tanks, would find it difficult to distinguish a Mark IV from a Mark V, at least when viewed from the outside. Inside it was quite different.

It began with the engine. The 105hp Daimler used in tanks Marks I–IV was clearly under-powered but an attempt to uprate it to 125hp was disappointing, and commitments to the Aircraft Production Department prevented the Daimler Company from developing anything more powerful. There was no other suitable engine available and few opportunities to develop one since the aircraft industry already had a firm grip on the majority of eligible firms.

Precisely what happened next is open to various interpretations, but on balance it seems that the project began in October 1916 when an ingenious young engineer, Harry Ricardo, was tasked with developing a new engine. His brief was daunting: Ricardo was not permitted to use significant materials such as aluminium, and the engine was required to develop more power yet fit into the same chassis space as the Daimler and should not exhaust great clouds of smoke that revealed the location of a tank on the battlefield.

As if this were not enough Ricardo was expected to find firms capable of building hundreds of these engines quickly. According to Ricardo himself the order to begin this work came from Eustace Tennyson d'Eyncourt in his role as Chief Technical Advisor to the Department of Mechanical Warfare Supply under Albert Stern.

Stern, characteristically, claims Ricardo as his own and implies that he discovered him – apparently dating this to January 1917. In fact Ricardo was drawn into the tank



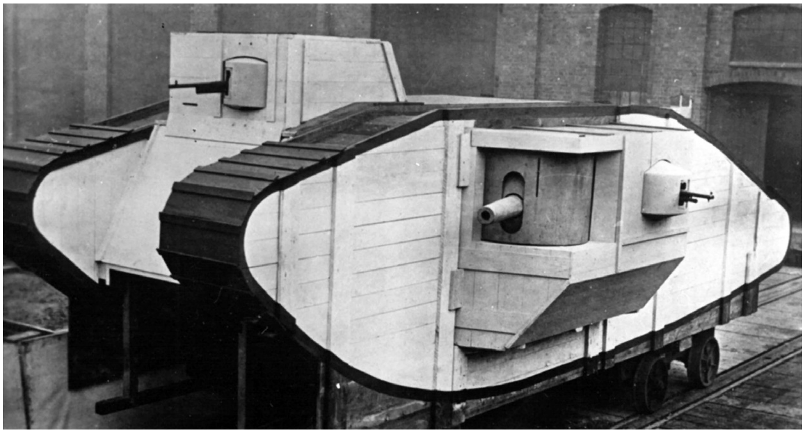
MARK V MALE TANK, 9TH BATTALION, TANK CORPS, FRANCE 1918

There are four relatively foolproof ways to identify a Mark V from any other British tank of World War I. From the rear it should be possible to identify the hatch in the vertical back plate, which, in conjunction with the box-shaped rear cab is unique to the type. The cab itself is effectively a cube, visible from both sides and the rear. If the front and rear faces are vertical then it is a Mark V, if they are angled it is a Mark V*. Also on either side are the square ventilation panels near the back through which air passes to the radiator. They will immediately distinguish a Mark V from a Mark IV, but they also appear on the Mark V*, which is longer and has the modified rear cab. From the front the most obvious feature is the different size of the two hinged flaps in the front plate of the cab. That on the left, as one looks at it, is of regular size for the driver while the one on the right, for the machine-gunner, is narrower. This quickly identifies a Mark V from a Mark IV, but is not adequate to distinguish a Mark V from a V*.

The battle of Moreuil (or Sauvillers), on 23 July 1918 was the second time that Mark V tanks were used in action. They were in the hands of 9th Battalion Tank Corps and were operating in support of the French 3rd Division. The attack was a success and the French were so pleased that the entire tank battalion was awarded the Croix de Guerre and given the honour of wearing the 3rd Division badge with the motto *Qui s'y frotte s'y brule* , which was worn on the uniform sleeve and later painted on the tanks. (Art by Henry Morshead, © Osprey Publishing)

programme at quite an early stage, when William Tritton of Fosters asked him to come up with a means of centring tanks on railway wagons, a requirement that soon vanished as tank drivers improved their skills. It is also worth pointing out that Ricardo already had a fine reputation as an innovative engineer and had friends in the tank world dating back to his university days. It was this reputation, these contacts and the fact that he was already on hand that seemed to have worked in his favour.

Much of the initial work was done inside Ricardo's head and it is clear that he had been thinking about the problem from an early stage. Meanwhile he discovered a group of industrial gas-engine manufacturers, mostly in the Manchester area, who were prepared to build to his design. There were seven in all under the parentage of Mirlees, Bickerton and Day, but Ricardo was closest to the firm Peter Brotherhood of Peterborough, with whom he had worked on some earlier projects. They hurried through the construction of a prototype to Ricardo's design, which was ready for testing by March 1917 and this enabled him to gain a head start over the tank production people.



A full-size wooden mock-up of the original Mark V proposal was trundled out from Metropolitan's Saltley works in Birmingham on 23 June 1917. It was an entirely new design with a reshaped hull, which is probably why it was never adopted.

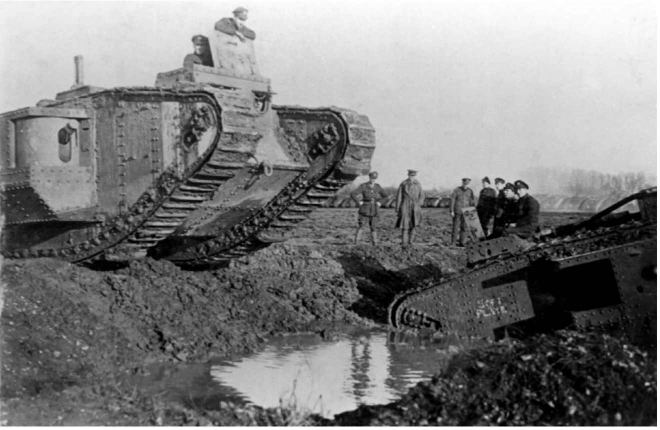
The Ricardo engine, as it became known, was a straight-six of 19-litre capacity. Unable to increase the length and width of the engine Ricardo took the only other option and made it taller; he employed a crosshead valve system, similar to that used on a steam engine and prevented surplus oil from reaching the crowns of the pistons, which would result in smoke from burned oil. He avoided the use of high-tensile steel and aluminium and even incorporated large removable panels in the crankcase so that a good deal of maintenance could be done with the engine in situ.

Ricardo was happy that the new engine could be made to deliver 200hp, but was told by W.G. Wilson, one of the original tank designers, that this would place too much strain on the transmission and instead reduced it to 150hp. Whether Wilson was referring to the original drive train of the Mark IV or his own epicyclic design is not clear.

THE FIRST MARK V

A party from the United Kingdom visited Central Workshops in France on 17 April 1917, during a lapse in the Arras battles. Their object was to show the senior staff in France the General Arrangement drawings of a new tank, to be known as the Mark V. It is worth remarking that at this time the first example of a Mark IV tank had yet to arrive in France. Colonel Frank Searle, the officer commanding Central Workshops, soon learned that this was not a matter open for discussion – what they were shown was to be the Mark V tank and 'no alternative would be entertained' – or maybe not. The overall design is credited to Wilson.

Finalized drawings were dated 9 June 1917 and at the end of the month, on 23 June, a full-size wooden mock-up was rolled out from the Metropolitan Railway Carriage and Wagon Company plant in Saltley, Birmingham, so we have a good idea of what it would have looked like. Since it was never built and we have this view of the mock-up there is no need to provide a lengthy description, but it is worth pointing out the longer hull, enlarged male sponson with improved machine-gun mounting, the apparently taller driving cab and rear cab with machine-gun position. It would have been powered by the new Ricardo engine, linked to Wilson's transmission and have wider, 24in tracks. Two other points are worth making. First the machine guns appear to be of the Hotchkiss pattern, at a time when the Lewis gun was still very much in favour. Second there is clearly no provision for an unditching beam, a device that had not been developed when the first drawing of this tank was prepared. At the same time Metropolitan showed off a wooden mock-up of an even more revolutionary tank that was given the designation Mark VI, which also failed to enter production.



What would appear to be a very early example of a Mark V is seen here with its nose stuck in a deep puddle. The words 'SOFT PLATE' on the side, and the absence of guns, suggests a prototype. Overlooking it is another Mark V, with grousers fitted to the tracks and the 6-pdr gun – in what appears to be a Mark IV sponson – retracted.

It is pointless attempting to evaluate this Mark V design; all one can say for sure is that the reason it was not built was as a direct result of the large-scale orders for the Mark IV machine that had already been placed. Indeed nothing reveals the differences between the military user and civilian manufacturers more than the fate of this tank.

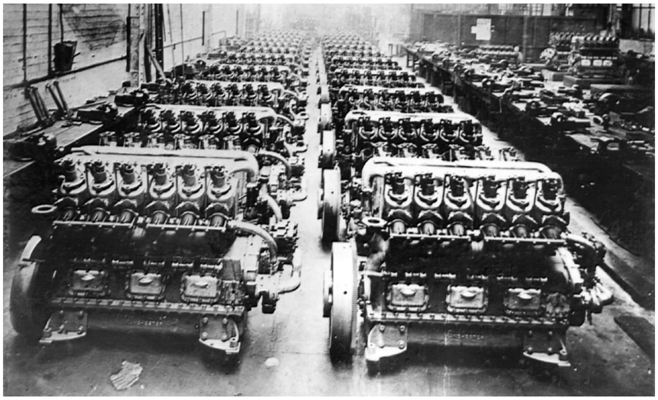
THE REAL MARK V

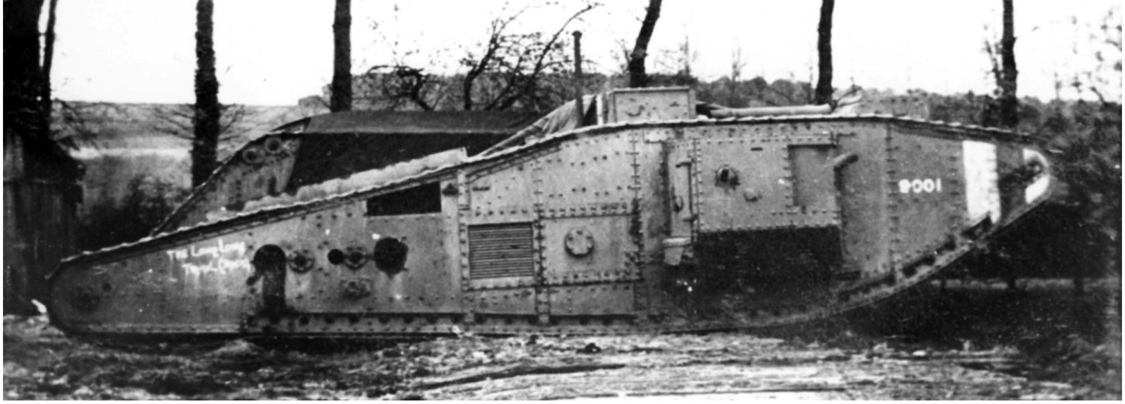
The war made unheard-of demands of British industry, not just on obvious things such as guns, ammunition, aircraft and warships, but on military transport, merchant ships and the British railway system, which was showing signs of collapse under the strain. Tanks were latecomers that increased the pressure on industry and they were not even the top priority, not by a long way.

When Albert Stern placed huge orders for the Mark IV tank towards the end of 1916 he was undoubtedly fulfilling Haig's demand for 1,000 more tanks and ensuring that the British tank force would have enough machines to see it through the difficult year ahead, but he was also clogging up the production lines with a type that many agreed was already out of date. This is why Ricardo was instructed to make sure that his new engine would occupy the same space as the Daimler and why Wilson's steering system was likewise evolved to fit existing tanks. The plan was to fit these items into late production Mark IV hulls, producing what was to be known as the Mark IVA for 1918. In the event the modifications required to adapt the Mark IV in this way proved to be more trouble than they were worth, and apart from a few experimental prototypes production switched, late in 1917, to a new model built from the tracks up yet recognizably a close relation to the Mark IV and earlier models. The first complete machine rolled out of the Birmingham factory in December 1917. Quite which factory, however, is not clear.

The sole contractor for Mark V tanks was the Metropolitan Carriage, Wagon and Finance Company, representing a group of companies, railway rolling stock manufacturers, amalgamated in 1902 by the mercurial industrialist Dudley Docker. Two of its factories, the original Metropolitan Company works at Saltley and that of the Oldbury Railway Wagon and Carriage Company, at Oldbury of course, had been turned over to tank production in 1916. There is no proof, but evidence suggests that Mark V production was focused entirely upon the Saltley plant, because Oldbury was still building Mark IVs. In any case the testing ground for tanks built at both works was adjacent to the Oldbury site, so it is entirely possible that Mark V tanks were also built there.

Ricardo 150hp engines at the Crossley Brothers works in Manchester. This is a remarkable output for a relatively small firm and production could be sustained only by spreading the work over as many producers as possible.





The original Mark V male tank 9001, probably photographed in France and fitted with a Tadpole Tail extension. Behind it is what appears to be a Mark IX Supply Tank, one of which also went to France.

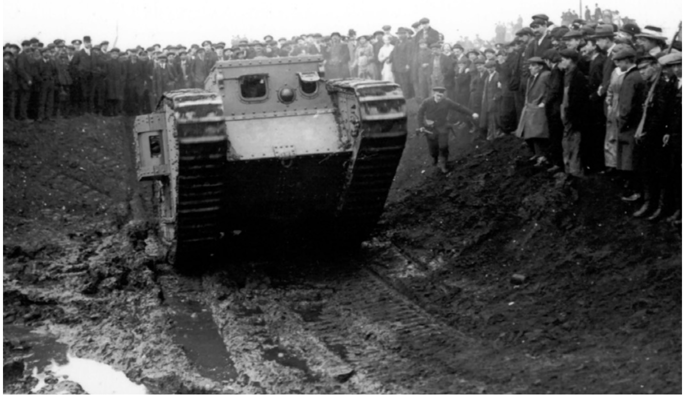
Since, once again, we are examining a machine that has a lot in common with its predecessors the best course seems to be to look at those features that are different and in particular features that serve to identify a Mark V from a Mark IV. Starting at the front the Mark V and its derivatives can easily be identified by the size of the two hinged visors on the vertical front face of the cab. The one on the right, as you look at it, is narrower than the one on the left, reflecting the fact that the driver, behind the wider visor, now had total control over the tank. It should also be noted that the narrow vision slits that hitherto helped to identify the various types were now eliminated from the front plate, and a large hatch located on top of the cab, something foreshadowed in late production Mark IV tanks, was now standard.

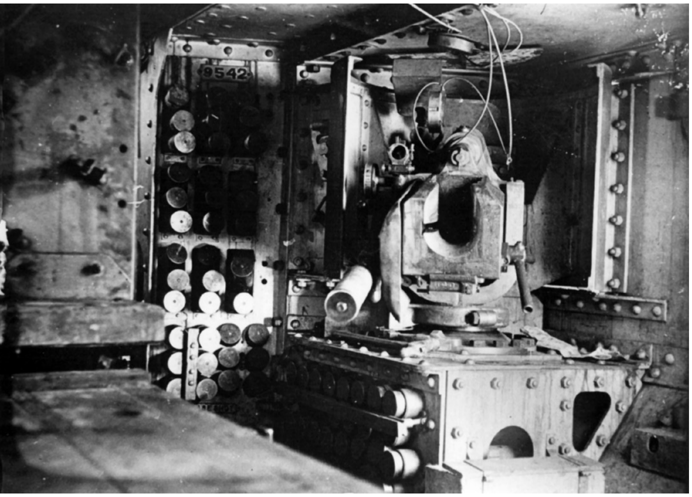
To the casual viewer the sponsons are identical on Marks IV and V; they were certainly interchangeable, but there are differences. On female machines these are limited to a loophole in the upper surface, suitable for firing a pistol through, or maybe showing a flag, and on the new tanks, which would carry the slimmer Hotchkiss machine guns, there are slight differences in the shape of the rotary shield.

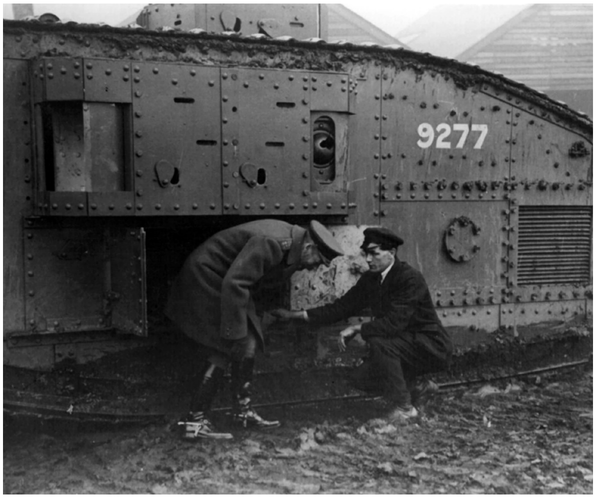
In the case of male tanks the significant difference is internal, although there is evidence of this on the outside. In a sense it is a reversion to the arrangement in the Mark I tank in that the pedestal that supported the gun was bolted to the top of an ammunition locker that held 16 rounds. This change can be identified from the outside by a vertical line of three rivets, bisecting the lower front plate of the sponson. Once again there is a protected loophole in the top plate, but otherwise the sponsons are essentially identical. It is in the area behind the sponson that the greatest changes may be noted. On each side of the hull one may easily see the square louvred panels that are the air inlet (left) and outlet (right) through which cooling air for the radiator passes, and on top the full-width box-shaped rear cab, another very distinct feature of this type. The radiator itself was a tall slim thing located on the right side, up against the hull with a tubular reserve tank in front. The louvres on each side are linked by metal ducting running across the rear, which contains the radiator cooling fan.

The rear cab is probably the most distinctive feature of the Mark V, although there is some evidence that the design was first tried out experimentally on one or more Mark IV machines. Now that he was relieved of any responsibility for actually driving the

This unusual photograph shows a very bare Mark V female giving a demonstration at Fosters of Lincoln. Odd, because Fosters never built the Mark V. Even so it seems to interest the crowds.







tank the commander was not obliged to occupy the seat next to the driver, so he could move back to this position where he might get a better view of the area all around. From here he also had control of a simple semaphore device, operated by chains, by means of which basic signals might be sent from tank to tank, and also cable-operated devices, leading to pointers in the sponsons of male tanks by means of which the direction and range of suitable targets might be indicated. How well either of these things worked, or how often they were actually used, is not clear.

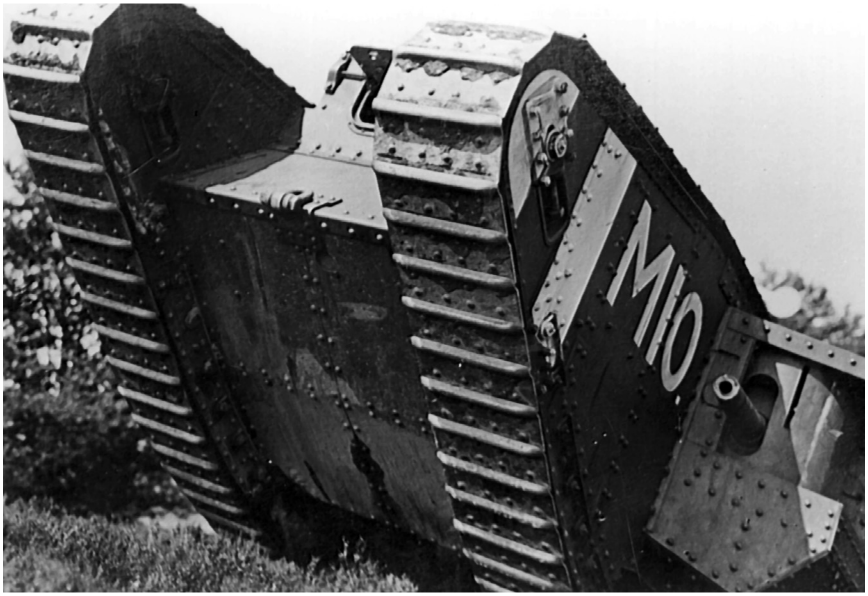
This rear cab, however, had another purpose. The sides, which were hinged at the top, could be swung open in order that crew members might attach the unditching beam to the tracks without actually having to climb outside their tank. Sometime early in 1918 an officer believed to be Major Philip Johnson, from Central Workshops in France, made a tour of various tank facilities in Britain. In Birmingham he found Major Harry Buddicom working on a number of projects, including unditching beams, and he credits Buddicom with the design of the rear cab and a sprung-catch device that was supposed to hold the beam in place when it was not required. The rear cab caused the rails supporting the beam to be raised and the unditching beam itself was invariably carried just ahead of the rear cab.

At some stage a bracket was riveted to the roof of some tanks, just in the rear of this cab, which supported a substantial towing hook. This equates to the temporary measure known as the 'top towing' system used on some Mark IV tanks at Cambrai the previous year. The sloping part of the roof at the very rear, which supported a stowage tray on the Mark IV, was now formed from two large hatches, hinged at the front, which could be raised and propped open. No specific purpose is recorded for these, although ventilation must have been one. No doubt they were a help when loading stores aboard, a suitable place from which to release a pigeon and, as a last resort, as a means of escape. The vertical plate that forms the back of the tank contained a rectangular hatch, in the centre of which was a ball mounting for a rearwards firing machine gun. Compared with the Mark IV it was a lot easier for a man to move around in the back of the Mark V so there would be no great difficulty in working this gun, but it would need to be used with care. It is presumed to have stemmed from the habit of some enemy troops, particularly machine-gun teams, of lying low when the tanks went by in order to pop up and attack the following infantry. However it was said that the improved manoeuvrability of the Mark V

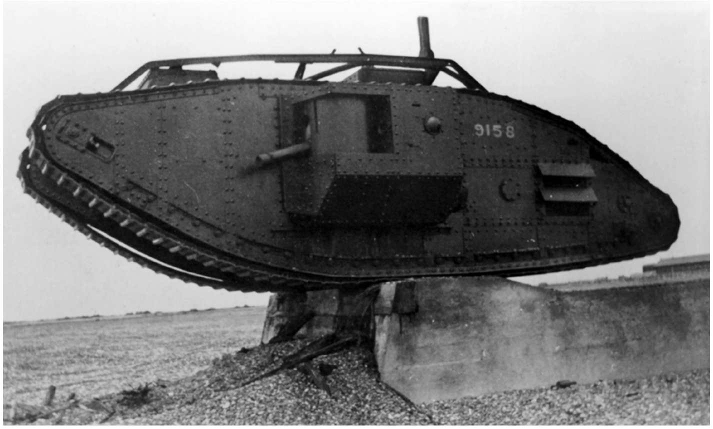
Above This picture, also taken at Fosters, reveals that His Majesty King George V was there and demonstrates how to dismount, fairly elegantly, from a female machine. It also serves to show some of the key features of a Mark V female tank; the air intake louvre on the right, the rear cab and the doors beneath the female sponson.

Above Left Here we have an interior view of a male sponson, although 9542 was in fact a Mark V*. Notice how ammunition is stowed in the pedestal beneath the gun, the lower part of the track frame, and that someone has forced 57mm rounds into the machine-gun ammunition slots directly above. The cables presumably link to range and direction indicators operated from the commander's cab.

This dramatic picture of a Mark V of B Company, 13th Battalion, provides a clear view of the rivet pattern on the male sponson. The photograph was taken at Kalterherberg, Germany, in July 1919.



This picture of 9158, a male Mark V doing a balancing act, shows how the lipless tracks drop away from the frames, which made it a lot more likely that they would come off.

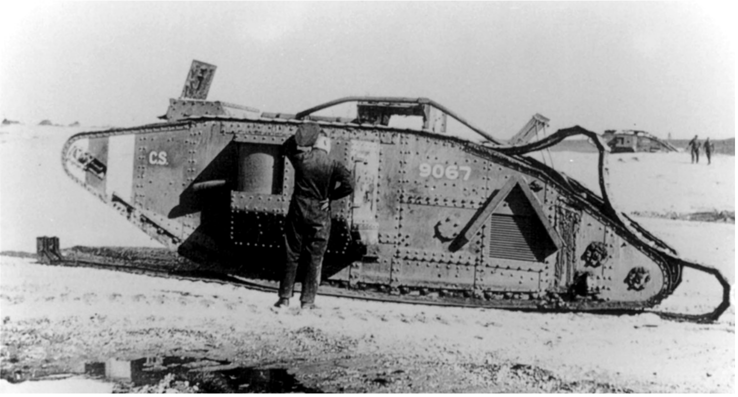


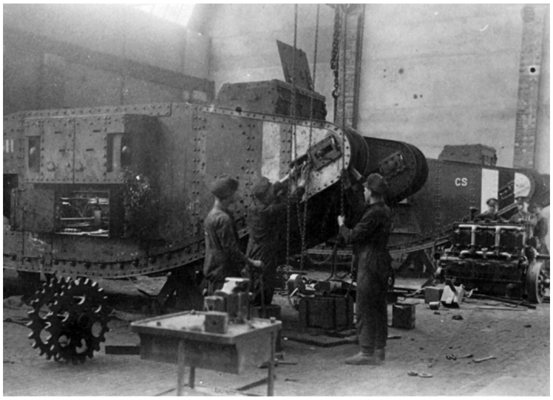
meant that anyone employing these tactics was at some risk of being run over, if they were spotted by the driver. Near this hatch was a bell pull that an infantryman could use to attract the attention of the crew in battle.

At the very rear, sandwiched between the horns, was the armoured cover for the fuel tank. In fact it enclosed three tanks with a total capacity of 90 gallons, 15 more than in the Mark IV, which in theory extended the Mark V's range by ten miles to 45 miles. Fuel delivery to the carburettor was still by the Autovac system. Hinged to the rear of the petrol tank armour was a metal-framed carrying tray that appears to have been used for stowing drums of lubricant and similar large loads.

CREW DUTIES AND CONDITIONS

Despite the fact that one man could now drive the tank entirely on his own the Mark V still retained an official crew of eight men. The driver himself controlled a four-speed gearbox with independent reverse. This gearbox, manufactured by the Wrigley Company, was designed for use in railway locomotives with internal combustion engines – hence the requirement for an independent reverse. It was still necessary to stop the tank in order to change gear, so the driver was trained to select a suitable gear for the ground ahead and stay in it as long as possible. Steering, on the other hand, was simplicity itself compared with the labour-intensive system employed on previous heavy tanks. The driver had a pair of levers that released reaction brakes on the epicyclic (or planetary) gearbox on one side or the other. This detached drive from the track on that side so that all of the engine's power went to the other track.





Above Left What to do? A Mark V of Central Schools at Bovington that has shed a track during a training run. Restoring it is heavy work, but the tank will not go anywhere until it is done. Notice also that every flap and hatch on this tank is wide open, presumably to clear the fumes.

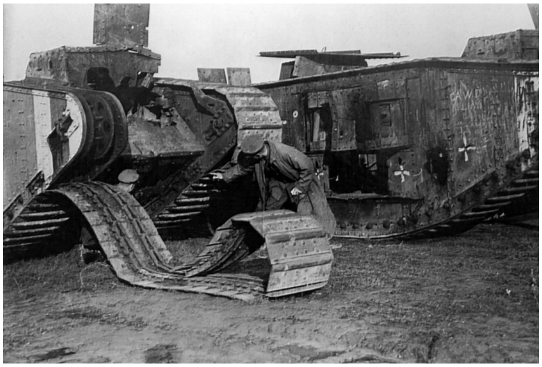
Top These tanks were photographed in the workshops at Bovington undergoing a major overhaul. Both are jacked up on trestles with their tracks off and engines out; chain hoists notwithstanding, this was still very much manual labour.

Normally this would be sufficient to swing the tank around, but if a tighter turn was required application of the footbrake locked the undriven track, and the tank would spin round on the spot.

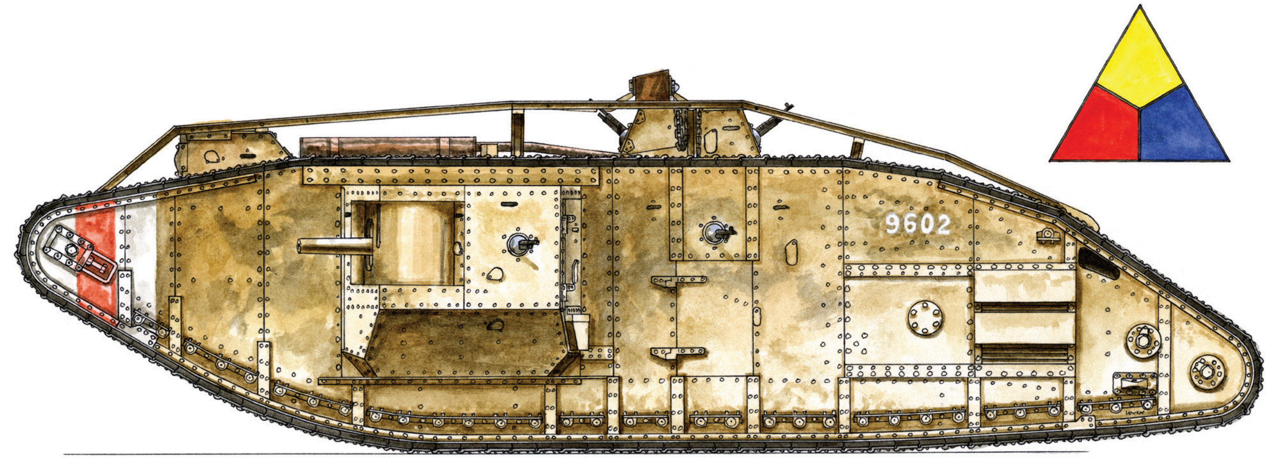
The driver was in communication with the commander by means of a speaking tube leading back to the rear cab, and he also had in front of him a distance indicator, calibrated in yards, and a compass. If the engine was warm it was possible to restart it by means of an extra magneto, in reach of the driver. If not the crew reverted to the traditional method, using a detachable hand crank behind the engine. Those tanks that survived the war appear to have had electric starter motors fitted. A man sitting alongside the driver was the designated front machine-gunner. To his left was a fresh water tank and a revolver case. Four men attended the sponson guns, just as in all previous tanks: two machine-gunners each side in female machines, or a gunner and loader in the male version. The machine guns were all of the Hotchkiss air-cooled type to the traditional British .303in calibre. The male tanks mounted two Hotchkiss 6-pdrs with the shortened (23-calibre) barrel. A design appeared for a lighter version of this gun with a horizontal sliding breech instead of the vertical type, but there is no evidence that any were ever actually fitted in tanks.

A male tank was stowed with 183 rounds of shell and 24 of the new case shot. Quite a reduction compared with the Mark IV, although there appears to have been an increase in small-arms ammunition for the machine guns, no doubt based upon earlier experience.

The commander's cab at the rear was originally provided with a series of lookout points and pistol ports, but most of these appear to have been eliminated later on; perhaps they proved to be too vulnerable. Even so it provided him with a far better view of the battlefield than he could have obtained from the front cab, although quite how well the speaking-tube link with the driver worked – or indeed the indicators to the gunners in male tanks – is not clear. The eighth man, if he was not required for anything else, manned the rear machine-gun position when the tank was in action.



This view shows salvage work being carried out on a damaged Mark V*. Notice how the flanged tracks hang down from the switch plate where they engage with the track frames. These are the wider (26½in) tracks. The photograph was taken at Central Workshops, France, in October 1918.



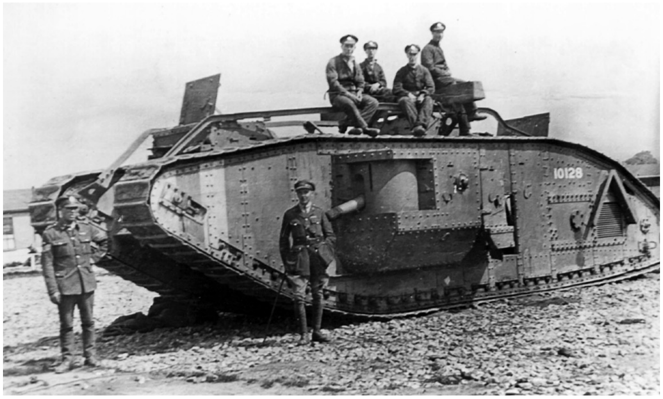
MARK V* MALE TANK, COMPANY A, 301ST TANK BATTALION, AMERICAN EXPEDITIONARY FORCE, FRANCE 1918

The 301st was the only American Heavy Tank Battalion to see action during World War I and it was equipped exclusively with British Mark V and V* tanks; it therefore served alongside the British Tank Corps and adopted the British battalion organization of three companies, each of four sections of four tanks. The Americans do not appear to have applied any individual markings or names to their tanks at all, so the only features visible would be the tank's own number, in white towards the rear, and the white/red/white recognition stripes, which could also be seen on British tanks.

The only surviving example of a Mark V* tank, a male machine, can be found in the Patton Museum of Cavalry and Armor at Fort Knox, Kentucky. The triangular device is the insignia of the United States Tank Corps. (Art by Henry Morshead, © Osprey Publishing)

Despite the fact that the engine was totally enclosed by concertina folding panels, and equipped with a fan cooling system for the exhaust pipe, conditions for the crew inside a Mark V are said to have been far worse than in the Mark IV. This appears to have been due to the new ducted cooling system for the radiator, which drew in air from the outside, so that fumes built up rapidly inside the tank; there are many accounts of crew members becoming temporarily incapacitated by carbon monoxide poisoning. A sliding shutter had been incorporated in the ducting, which was supposed to supply fresh air to the interior of the tank, but it appears to have been fighting a losing battle. Later an extra shutter was fitted, which drew contaminated air out of the crew area, and this appears to have made a difference. Otherwise things had changed little for the crews since 1916. The Mark V was a little bit faster than its predecessors in top gear, but the ride was as bumpy as ever and the effect of incoming fire equally bad.

Mark V* male tank No. 10128 at Bovington, training men for the 1st Canadian Tank Battalion in 1918. Notice the inverted V-shaped device to keep rain and mud out of the radiator cooling inlet.



Another innovation, possibly the result of so many Mark IV tanks falling into German hands following the battle of Cambrai, was a charge of guncotton placed alongside the gearbox, which the crew were supposed to detonate should they have to abandon the tank. Although a number of Mark V tanks were knocked out in battle none are known to have fallen into German hands. However, since by the time the Mark V was used in action progress was almost entirely in the Allies' favour, this would have reduced the chances of any being captured.

The problem of wider trenches, first confronted at Arras and then Cambrai in 1917, resulted in the development of the Tadpole Tail extension fitted to some Mark IV tanks but never used, and there are a few instances of the same device being seen on Mark V tanks. There is no reason to suppose that they worked any better on the new tank, but in any case something much better was in the offing.

THE MARK V*

In the summer of 1917 Tank Corps Headquarters in France instructed Central Workshops to investigate the possibility of building a longer tank. Searle handed the task over to No. 2 Repair Section, which in effect created a 'stretched' Mark IV by cutting a tank in half and inserting an extra 6ft of hull, adding about four tons to the overall weight. One source claims that the design was the work of Lieutenant J.G. Rackham.

Searle says that in this form the tank was even more underpowered, which is hardly surprising; it was most noticeable when the tank turned, or swung, and it was not just the additional weight, as Searle appreciated, but the extra track in contact with the ground that made turning so difficult. We have no hard evidence as to what this improvised tank looked like, but it represents the origins of what later became the Mark V*. The practice of adding an asterisk, or star, to denote a modification to an existing design seems to have originated in Royal Artillery procedure.

There is no truth in the suggestion that existing Mark V tanks were converted to Mark V* by stretching the hull and other modifications; all Mark V* tanks were of totally new construction and all built in Birmingham under the Metropolitan umbrella. However it should be noted that of the 700 tanks ordered, 579 were completed by the time of the Armistice and a further 66 subsequently before the contracts were wound up.

The Mark V* was easily told from the Mark V by its greater length, but there were two other features worth recording; there was a door on each side just abaft the sponson, which made getting in and out a bit easier, and a machine-gun mounting was normally seen in the panel directly above this door, although in some cases this was eliminated. Most significant was a redesigned rear cab that had sloping front and rear plates instead of the vertical ones on the Mark V, which included Hotchkiss ball mountings in both faces. Two reasons have been suggested for this: first that, based upon experience in built-up areas, such as the village of Fontaine-Notre-Dame in the Cambrai battle, it gave the tanks a weapon capable of dealing with enemy troops in the upper storeys of houses; and second, that it enabled the tank to fire back at attacking aircraft. Given the chances of seeing one of these, never mind hitting it, the former suggestion seems to be the more likely. Mark V* tanks are more commonly seen with the wider, 26½in tracks, and at various times they are seen with baffles of one sort or another over the side air inlet grilles to keep mud out.

The logic behind a longer tank was clearly to cope with wider trenches such as those the Germans were incorporating into their extensive defensive system, which the Allies always referred to as the Hindenburg Line. It meant that a longer tank could tackle a succession of such trenches without having to worry about carrying a fascine or crib. It also had a limited personnel-carrying capability of just 14 or 15 men, and up to four machine guns to be dropped off in captured trenches during the advance, what the chronicler of 13th Battalion referred to as 'the Trojan Horse of the (Tank) Corps'.

THE MARK V AND V* IN SERVICE

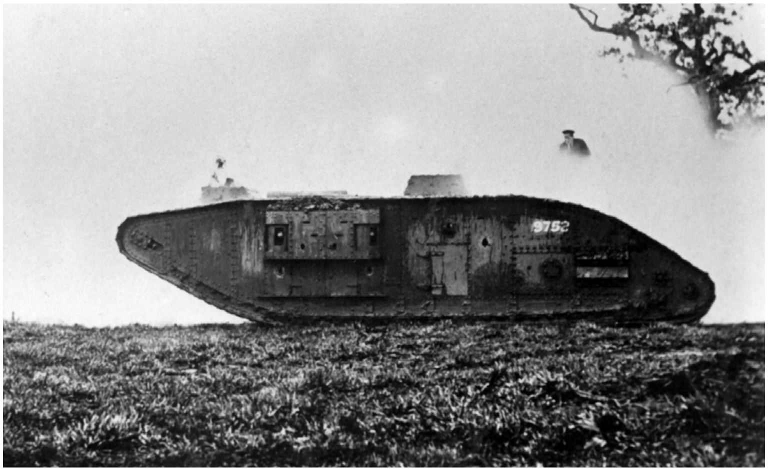
The first Mark V ran for the very first time on 18 January 1918, but a contemporary source adds that there was no time to conduct the usual endurance trials; production would have to commence at once. In April the first production tanks started to arrive in France. Again it seems that there was precious little time for detailed familiarization, either at Central Workshops or indeed at battalion level. On the other hand staff at Central Workshops had a bit of prior experience with what later became known as the Mark V Experimental Machine E.M.E. Those letters give away what it really was. E.M.E. (Experimental Machine E) was a Mark II tank, one of the competitors in the Oldbury Trials of March 1917 that was used to demonstrate Wilson's epicyclic steering system. Subsequently fitted with a Ricardo engine it was, in mechanical terms, essentially a Mark V and in that form at least provided the staff at Erin with a sample to work upon.

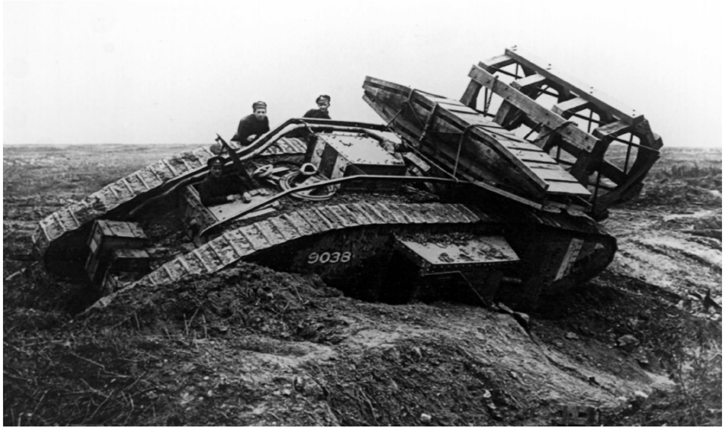
The 8th and 13th Battalions of the Tank Corps were among the first to re-equip with the new tank, both having had some experience of the Mark IV. A section commander of 8th Battalion, Captain Douglas Hickey, remarked that one could walk comfortably behind a Mark IV and still keep up with it, but the improved speed and manoeuvrability of the Mark V meant that you had to step out to keep pace. In its War Diary 8th Battalion claims that it was the first Tank Corps unit to receive the new tank, in April 1918, but oddly fails to make much of this by way of comparison, merely saying that the tanks arrived at the Tankodrome at Blingel where their crews went to pick them up.

The 13th, although it had trained on the Mark IV, had only limited experience of using it in action, but seem to have been far more impressed with the Mark V:

> An engine of new design gave both greater speed and greater turning power, while a system of epicyclic gears made turning easy and under the sole control of the driver. The officer was free to supervise his crew, the gunner was free to use his weapon to the best advantage.

It would be both of these battalions that took the Mark V into action for the first time, at Hamel on 4 July 1918. This battle, which was largely an Australian affair, involved all of 8th Battalion plus B and C Companies of 13th Battalion – that is 60 tanks in all, supported by a dozen supply tanks of the Mark IV type. Liddell Hart makes the point that, probably for the first time, all of the fighting tanks were up to time,


A Mark V* female taking part in smoke-screen tests using sulphonic acid, injected into the engine exhaust system.



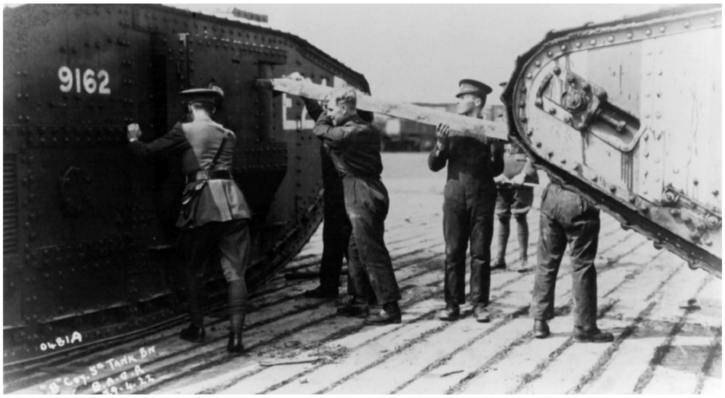
This unusual photograph shows a Mark V male, No. 9038, apparently ditched. It is not only carrying a trench-crossing crib but also a pair of wooden trench bridges of the kind used by the artillery. Other features to note are the stores, carried at the back of the tank, and the open rear hatch, occupied by a crew member.

on the start line with no breakdowns, which he ascribes to the quality of the new tanks. However it must have owed something to the dedication of the crews too, for they had to be on their mettle. The Australians had little time for tanks, following what they perceived to be a massive failure that let them down at Bullecourt back in April 1917, so the Tank Corps had something to prove. In the event it was a considerable success due to the tanks, the quality and detail of Australian staff work, and the fact that it had limited objectives; not one of those open-ended, ambitious schemes so beloved of Field Marshal Haig. Casualties to the Tank Corps were minuscule by the standards of the day; 16 men wounded and five tanks disabled, all of which were recovered from the battlefield afterwards.

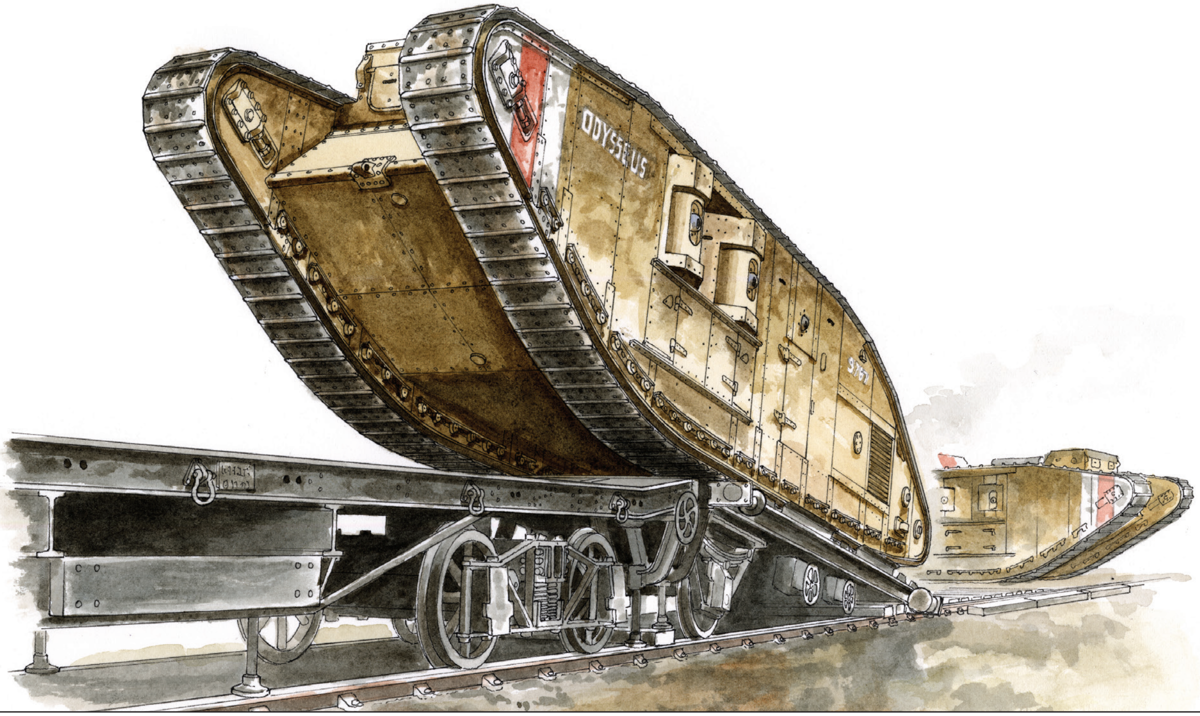
About three weeks later, on 23 July, 9th Battalion went into action with the French 3rd Division 'La Grenadiere' in a battle that the British know as Moreuil, although the French usually call it Sauvillers. Once again this proved to be a trial of the stamina of the Mark V tanks and their crews. The journey to the battlefield required a 25-mile run, or trek to use the term of the day, on their tracks and a long train trip. Thirty-five of the 40 tanks that set out were in a fit condition to fight upon arrival. The attack was so successful, although tank casualties were much higher than at Hamel, that the entire battalion was awarded a collective Croix de Guerre in addition to individual awards and given the honour of wearing the cap badge of the French 3rd Division as an arm badge.

The battle with which the Mark V, and the Mark V* come to that, are best associated is undoubtedly Amiens, which was launched on 8 August 1918. The initial idea was to squeeze a massive salient in the front line, created by the Germans during their spring offensive of that year. In effect, however, it was the first of a series of battles known collectively, if slightly inaccurately, as the Hundred Days, which culminated in the Armistice of 11 November 1918.

Figures for the number of tanks taking part are at odds, but impressive nonetheless. These are based on Fuller and show Mark V 378, Mark V* 72, Mark IV 84, Medium A 96 and 16 Austin Armoured Cars; 646 machines in all, though this did not include tanks in the supply role belonging to the specialist Carrier Companies. Infantry was drawn from the Australian, British, Canadian and French armies supported by a massive amount of artillery, although based on the experience of Cambrai the previous November there would be no lengthy bombardment in the days leading up to Zero Hour.



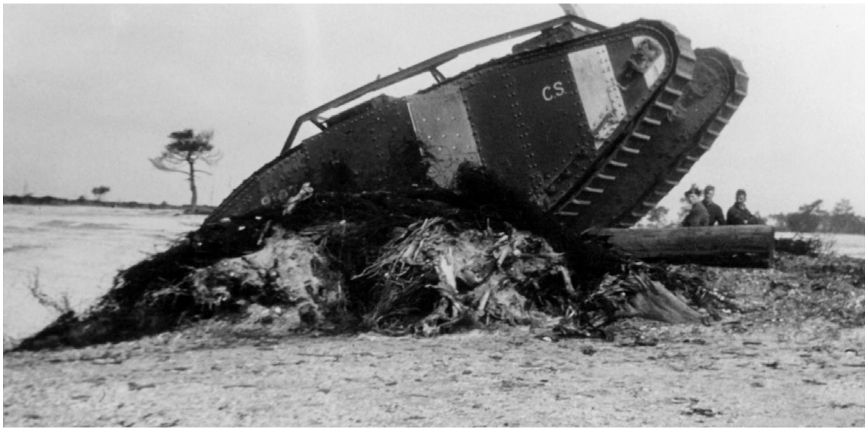
Preparing a tank for movement by rail could be a tricky and dangerous business. Here one tank is used to push in the sponson of another. 5th Battalion, Germany, 1922.



MARK V* FEMALE TANK *ODYSSEUS* BOARDING A RECTANK WAGON USING THE SPECIAL RAMP WAGON, FRANCE 1918

Moving tanks by rail was the only way to cope with the problem during World War I; they were too slow to travel any distance on their tracks and no road transporters existed that could handle the heavy British tanks. Initially, standard British and French railway wagons could just about cope, but with the promise of tanks becoming heavier a new, special-purpose wagon had to be designed. The task was entrusted to the Railway Executive Committee, which came up with a massively constructed bogie wagon, complete with supporting jacks, that could handle loads of up to 40 tons. Known as Rectank wagons, these vehicles were issued for use on British and European railways. Under normal circumstances, at railheads, tanks would load from side or end docks or on improvised ramps, but in 1918 a special ramp wagon was designed for use in the field. Produced by the Stableford Company, this was a four-wheeled wagon with a detachable axle that created a ramp attached to the last wagon of a train. With this device a ramp could be created anywhere in the field where tanks were required to be loaded or unloaded, although preparing it was hard, physical work.

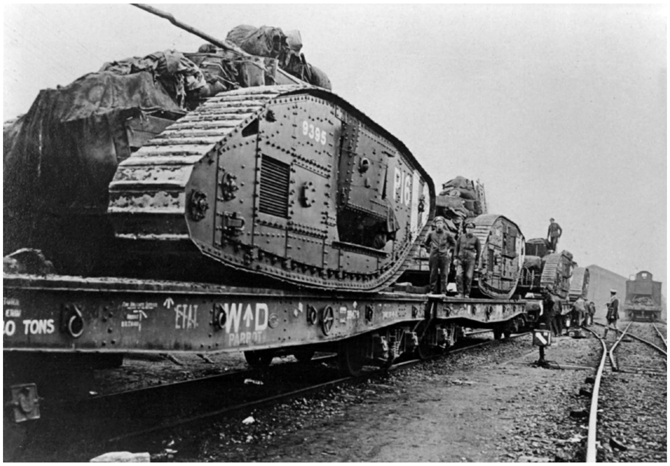
The female Mark V* weighed 33 tons, and in order to travel by rail it had to be placed accurately on the Rectank wagon, securely chained down and with its gun sponsons folded in to clear the railway loading gauge. The tank in this case is *Odysseus* of 10th Battalion, Tank Corps. (Art by Henry Morshead, © Osprey Publishing)



There is no evidence of Mark V supply tanks except for this photograph, taken at Bovington after the war when the survivors had been relegated to other duties.

ORGANIZATION

A booklet published by the War Office in 1918 includes a full establishment table for a tank battalion in the Tank Corps in France, although in some respects it might be regarded as a work of fiction. In theory, as far as tanks themselves were concerned, it differed little from the organization of battalions at Cambrai a year earlier, but other things had changed in the meantime. There were nine battalions at Cambrai but 15 at Amiens, 11 of which would be equipped with Mark V and V* tanks. So despite the fact that, according to one source, these tanks were arriving in France at the rate of 50 a week there would not be enough to equip all the battalions to full strength before the battle began.



Four 16th Battalion tanks, probably all composites, on Warflat wagons in Germany. The tank nearest the camera is fitted with the wider 26½in (673.1mm) tracks. All tanks are stacked high with stores and one of them is carrying a spare pair of drive sprockets.

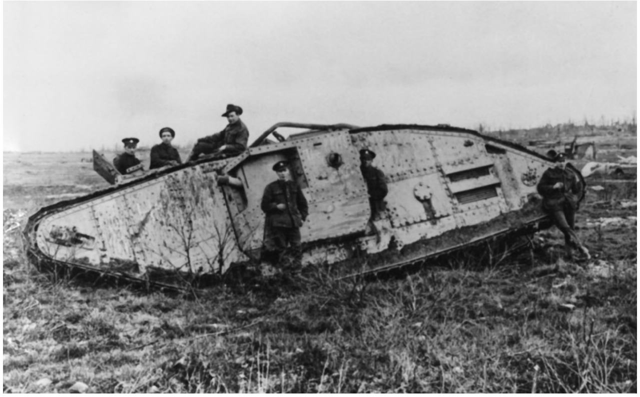
The establishment table shows that a battalion was organized on the basis of a headquarters and three companies, each company composed of four sections and each section of four tanks. That totals 16 tanks per company and therefore 48 tanks per battalion. However the reality was something else. For example 1st (A) Battalion claims that on the eve of Amiens it mustered 24 Mark V tanks and ten Mark V*, which with one left over works out at 11 tanks per company; this is indivisible by four, suggesting that some sections had only two tanks. Among the other battalions, 2nd (B) and 4th (D) can show 12 tanks per company at the start of the battle, although, of course, numbers dwindled rapidly as the fighting began, as we shall see.

However, tanks are only a part of a battalion's establishment. They also had 12 motorcycles, nine bicycles and, of all things, three riding horses. In terms of fighting manpower there were 196 officers and men per company plus at least 34 more per battalion in the shape of the battalion commander, a lieutenant-colonel, and under him various other officers and men, including such trades and duties as shoemaker, cook, groom, batmen and orderlies. And this does not include what are described as attached personnel, including an officer and four men of the Royal Army Medical Corps, a staff sergeant fitter of the Royal Artillery, an armourer from the Royal Army Ordnance Corps and even one NCO and man from the Army Gymnastic Staff responsible for physical and bayonet training.

Battalions had been grouped by brigades from 1917; at the time of Amiens there were five such brigades, but by no means all the same. For example, 3rd Tank Brigade consisted only of two battalions (3rd and 6th in Whippets), whereas 5th Tank Brigade had four battalions, while the others had three each. Transport and signalling staff were administered at brigade level. Even that is not the end of it: the Tank Corps in France was a big organization by 1918, with all manner of departments and depots, although these carry us beyond the scope of this work.

THE BATTLE OF AMIENS

Accounts of Amiens are many, and somewhat awkwardly varied. For example J.F.C. Fuller in *Tanks in the Great War 1914–1918* states that initially only 1st and 15th Battalions were equipped with the Mark V* tank, whereas the others, that is to say 2nd, 4th, 5th, 8th, 9th, 10th, 11th, 13th and 14th had only the Mark V type.

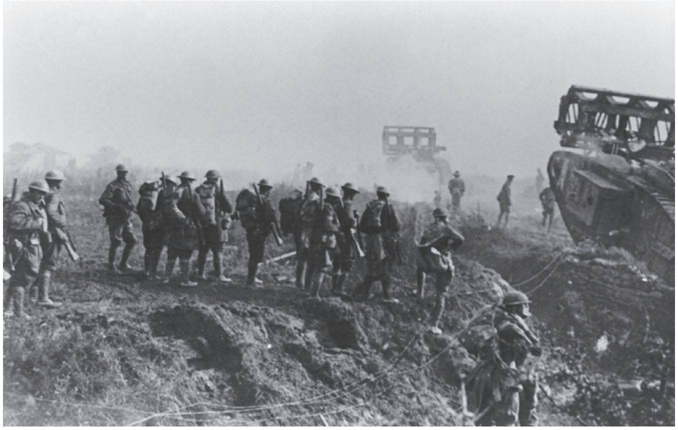


A Mark V male tank of 8th Battalion ditched on the Amiens battlefield with a Mark IV in the background. The presence of an Australian perched on top reminds us that in this battle 8th Battalion was among those supporting Monash's Australian Corps. There is no sign of the unditching equipment on this tank and the paintwork is very pale; maybe it has been there for some time.

However the War Diaries tell a different story, giving the impression that most battalions were issued with a mixture of the two types. There is a wealth of information in these documents, but it is rather fragmented, since each chronicler appears to have his own priorities; many of them are worth recording, nonetheless. For example, 1st Battalion, discussing their Mark V* machines, claim that in the extra space it was possible to cram two Lewis guns, each with a two-man crew; two Vickers guns, each with a four-man crew; an infantry scout; and one officer, a total of 14 men in addition to the regular crew. Another battalion claims that they could get 15 men into the tank and found room for extra ammunition on the roof. Bearing in mind that conditions inside were bad enough for the crew, who were used to it, the suffering inflicted on unprepared infantry was many times worse. Many are said to have left their tank at the appropriate place feeling so ill that imminent death seemed preferable to fighting.

Another interesting issue is thrown up by an entry in the *War History of the 5th Battalion*. It received some Mark V tanks in May 1918 and more in June, against which has been written 'wide tracks'. This presumably reflects the fact that around this time a new, wider track plate was introduced – 26½in instead of 20½in – in order to spread the weight and reduce ground pressure a little more. It is reported elsewhere that these wider tracks resulted in a problem on the British railway system and in particular the lines of the South Eastern & Chatham Railway, which led to the cross-Channel ferry port at Richborough in Kent. Apparently there were places where the edges of the wider tracks fouled the platform edge at some stations, although the solution seems to have been rather drastic. According to this report those tanks fitted with the new, wider tracks had a section of them removed and replaced by the narrower type, which were changed again before the tanks were taken on to the ferry. Since, one imagines, each tank had to be taken off the train in order to change over the tracks, the calculations required to ensure that, when it climbed back on to the train the tank finished up with the narrow tracks along the bottom, would appear to be stupendous. And while on the subject of tracks it is also worth recording that at around this time a new type of lipless track was introduced that did not need to engage with the track frames to stay in place. One battalion commander, writing later in the year, complained that lipless track gave endless trouble, particularly on long runs. Presumably if the track stretched and became slack it was likely to drop away from the frames and fail to re-engage – the very problem that had plagued the builders of the Number One Lincoln Machine back in 1915, which resulted in the design of Tritton's original lipped track.

The 11th Battalion had a different, if not unheard-of, complaint. They collected their tanks, recorded as Mark V and Mark V*, from the depot at Erin on 9 August 1918, the day after the battle of Amiens began. What they objected to was the vivid red/white/red stripes painted on the nose of each tank around that time; they were convinced that these provided enemy gunners with an easy aiming point. The stripes had been adopted in order to distinguish tanks in British service from those captured and re-used by the Germans. The same complaint resurfaced in World War II,



8th Battalion Mark V tanks with cribs moving up to the Hindenburg Line late in September 1918. A Mark IV supply tank is just visible through the mist on the left. Those signal cables in the foreground will be useless after the tanks have gone over them.

particularly in respect of the white Allied recognition star, but it was never substantiated so the stripes remained, as did the star a generation later.

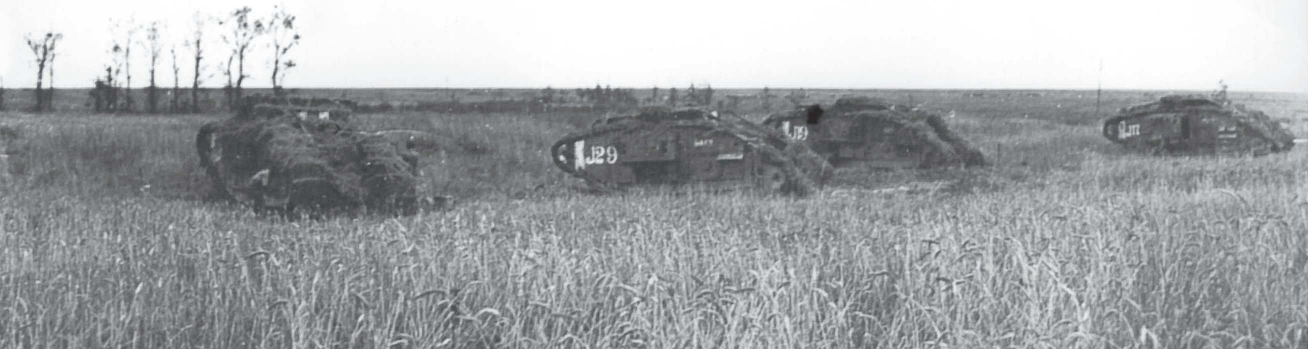
The Germans did not field any of their limited number of tanks in August or September 1918, and even when they did later in the year the only encounter was between Mark IV tanks. However the *8th Battalion War History* mentions an action overnight on 10th/11th August when one of their Mark V tanks opened fire on a wrecked Mark V* that the Germans had turned into a machine-gun nest. No result is given, but one assumes that the wrecked tank came off worse. It was probably the only time, during the early stages of the Amiens battle, when one British tank fired upon another intentionally.

Casualties among the tanks were undoubtedly high, due in no small part to the number of artillery batteries, practised in anti-tank work, that the enemy deployed in the open to meet the attack. Also, of course, with so many tanks on the battlefield there was an abundance of targets. Even so it is notable that, as the numbers dwindled day by day due to casualties and breakdowns, the percentage of those knocked out compared with those in action grew proportionately. For example by the third day only 67 tanks of all kinds were fit to send into action, of which around 30 fell victim to the German guns. It was a high attrition rate of a wasting asset.

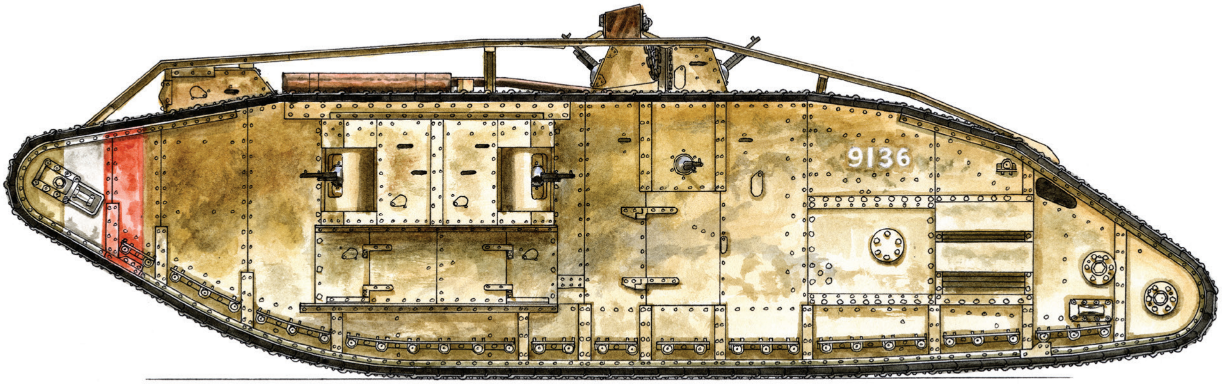
However, it was not all doom and gloom. There are 101 ways that tanks can be disabled on the battlefield, and so long as the area remained in British hands it would be possible to recover tanks and repair many of them for future use. It is a point worth bearing in mind whenever tank casualties are discussed.

J.F.C. Fuller, considered by many at the time as the doyen of tank warfare specialists, gave it as his opinion that from Amiens onwards neither the Mark V nor even the Whippet were anywhere near fast enough for the new era of open warfare. It is certainly true that the Mark V, a direct descendant of the Mark I of 1916, was by definition a trench warfare machine whereas the Whippet was at least intended to be a cavalry tank. It must be borne in mind that Fuller was busy promoting his own ideas on the future of war, in which much faster tanks played a key role, but at the time he was writing about, August and September 1918, there was still trench fighting to come.

Following upon the evident success of the Amiens offensive, described as a ‘black day’ even by the German High Command, Allied policy seems to have been to



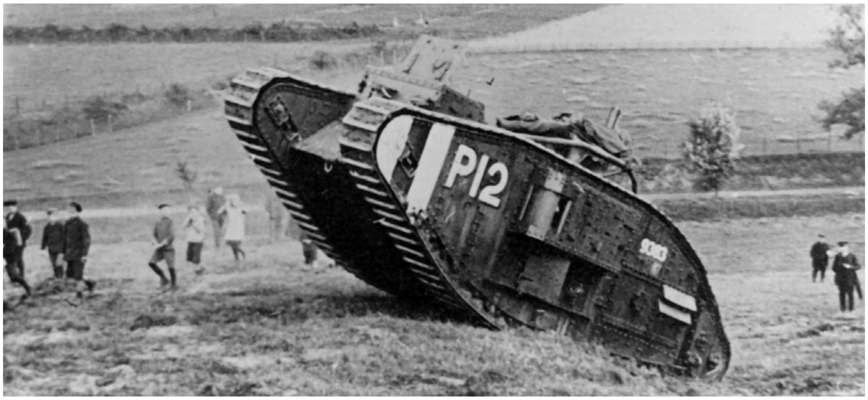
Mark V tanks of 10th (J) Battalion try to camouflage themselves with grass near Albert on 9 August 1918. The vivid markings tend to spoil the effect, but there is precious little cover anywhere.



MARK V* FEMALE TANK, **COMPANY C, 301ST TANK BATTALION, CAMP MEADE, MARYLAND, 1919**

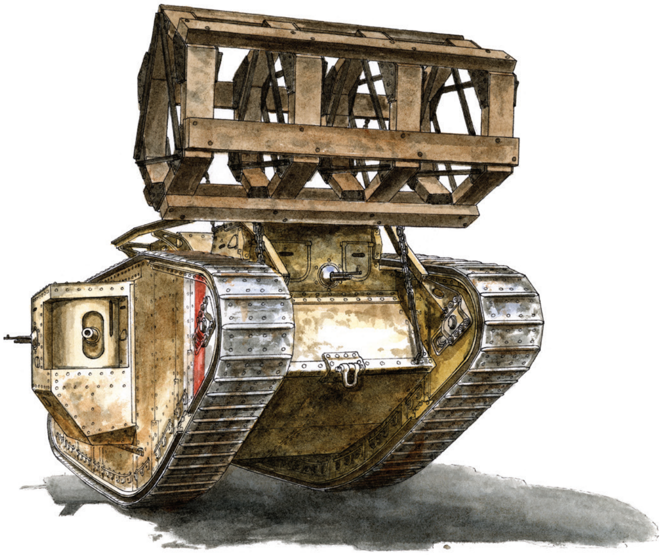
When the 301st Heavy Tank Battalion returned home at the end of the war it was first based at Camp Meade, Maryland. Here they adopted a new system to identify which company a tank belonged to, based upon the British system of identification stripes seen during the war. Company A simply retained the white/red/white arrangement, Company B employed two white stripes separated by a stripe of the same width in the regular brown tank colour, while Company C, as shown here, adopted red/white/brown with red rearmost. However this scheme does not appear to have lasted very long and it is not entirely clear whether the pattern was repeated on the front and rear cabs of the tank.

Another matter that is not entirely clear is whether the Americans retained the Hotchkiss machine guns normally fitted to these tanks or modified them to accept an alternative. In most surviving photographs they appear to carry no weapons at all. (Art by Henry Morshead, © Osprey Publishing)



This tank, carrying the markings of 16th Battalion, was photographed in Germany after the war. No. 9383 was built as a female and may well still be, although the chances are it is a composite, with a male sponson on the other side. Notice that it is fitted with the original 20½in tracks.

confuse and wear out the enemy by an unremitting series of attacks on different parts of the front, based upon the theory that the Germans could not be strong everywhere at all times. Even so, as we have noted, the attrition rate among the tanks was high, although new machines and even fresh battalions were soon to be available. On the British front the biggest obstacle, apart from the decaying and ruinous Somme battlefield of 1916, was the massive defensive system that Haig's troops knew as the Hindenburg Line. It snaked across the British zone, taking in St Quentin, the old Cambrai battlefield of 1917, and Arras, and was considered a formidable obstacle where it entwined, briefly, with the Canal du Nord.



MARK V MALE TANK WITH A CRIB TRENCH CROSSING DEVICE DURING THE ATTACK ON THE HINDENBURG LINE IN SEPTEMBER 1918

The crib was designed to fulfil the same function as the fascine used at Cambrai in November 1917. By dropping it into a wide trench it provided support for the rear end of the tank as it crossed over and prevented it from getting stuck. Designed and built at Tank Corps Central Workshops in France, the crib was bolted together from stout wooden beams and angular steel, braced by lighter steel bars. This proved strong enough to support a tank weighing up to around 30 tons as it crossed over. Compared with a fascine, the crib was much lighter, which reduced the strain on the tank that carried it, and of course it could be dismantled in situ and taken away for further use if not too distorted.

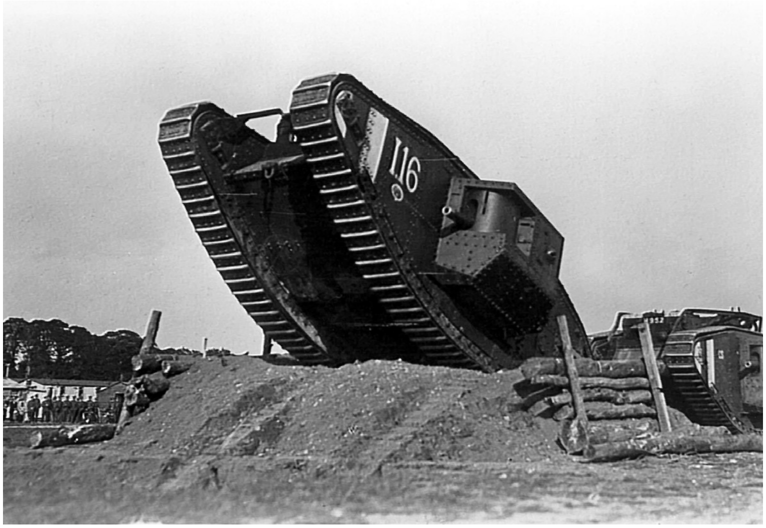
Cribs were only fitted to Mark V and a few Mark IV tanks for specific operations, Mark V* tanks could manage without them due to their greater length. (Art by Henry Morshead, © Osprey Publishing)

In particular, from late August into early September an attack was launched on a portion of the German front known as the Drocourt-Queant Switch Line. This had featured in the Arras battles of April 1917, but proved to be a tough obstacle and probably a trench line too far. Now, under pressure from tanks of the 3rd Tank Brigade, all either Mark V or V*, this section of the line gave way with surprising ease. Subsequent actions up to the end of September were mostly concerned with clearing the ground to the west of the Hindenburg Line in preparation for a major assault, due to kick off at the end of the month.

It was during this period that a lot of effort went into perfecting techniques of cooperation between tanks and aircraft. The Tank Corps had been allotted its own Army Cooperation Squadron (No. 8 Squadron, Royal Air Force under Major Trafford Leigh-Mallory). It was no easy matter; spotting aircraft from a tank was difficult and if the aircraft was signalling it was nearly impossible to read its message.

By the same token, despite the fact that tanks had their battalion identification numbers painted on the cab roof, it was not always possible to get an accurate reading. Trials were conducted with a camera obscura lens in the roof of a Mark V tank, projecting an image on to a sheet of white paper inside, but this generally seems to have been regarded as more trouble than it was worth, especially in the cramped interior of a tank. In the end, the most successful arrangement seems to have been in the form of contact patrols, with aircraft dropping messages at headquarters to report progress.

On 27 September a major attack was launched against the Hindenburg Line in the Cambrai area, in what is sometimes called the second battle of Cambrai. This battle saw



Many tanks came back to Bovington, where two Mark Vs are seen giving a demonstration. I.16 still carries the *Qui s'y frotte s'y brule* badge (roughly translated: *He who rubs against me is burned*), while the tank behind it carries the letters CS, for Central Schools.

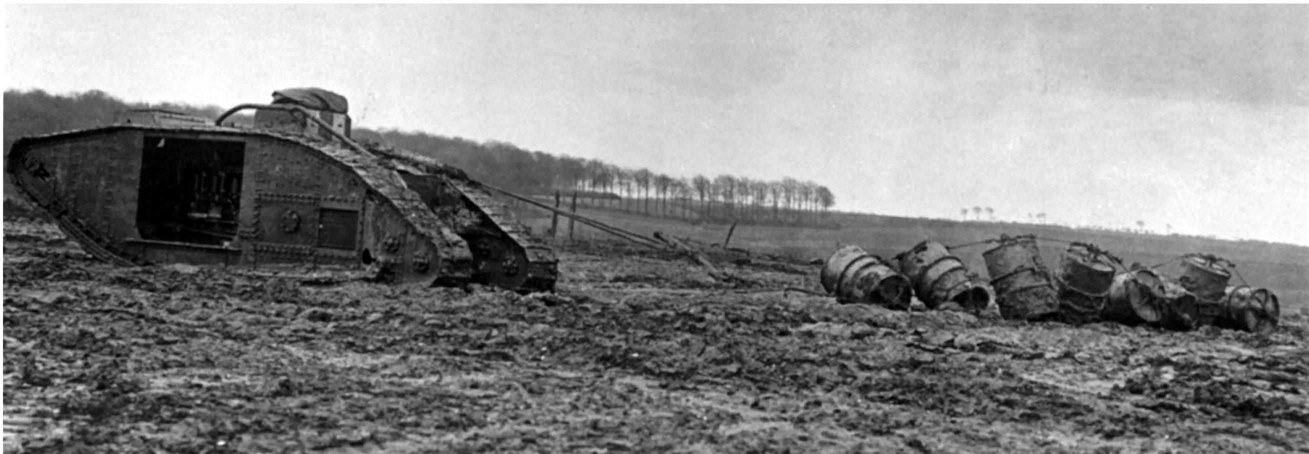
the debut of the 301st Battalion of the United States Tank Corps, which, since it was operating in British tanks, was incorporated into the British Tank Corps and formed part of 4th Tank Brigade. British histories claim that it was equipped exclusively with Mark V* tanks but the battalion's battle narrative tells a different story. It shows both Mark V and V* with a predominance of male tanks and, somewhat surprisingly, a number of so-called composite tanks, which had a male sponson on one side and a female on the other. The document also notes that all Mark V tanks carried cribs; the Mark V*, being longer, was assumed not to need them.

The crib was a replacement for the fascines used at Cambrai in 1917. Being made up from steel and wood, bolted together, it was a lot lighter than a conventional fascine and, in theory at least, capable of being salvaged. There are few accounts of their use, compared with the fascines of 1917, perhaps because the latter were something of a novelty, but it suggests that they served their purpose and did not create any problems. Fourth Battalion, which seems to have been equipped exclusively with Mark V tanks, records that it drew cribs on 21 September while another battalion claims that it selected skilled and experienced crews to man those tanks that carried cribs.

Conditions inside the Mark V tanks were still not much improved. There is an account of a tank with 13th Battalion that returned to the Australian Lines with all the crew, except the officer who was driving, incapacitated by heat and fumes. Since the Australians were desperate for help in dealing with enemy machine guns, the tank had to go back into action with the officer driving, one partially recovered crew member and two Australian Lewis gunners to operate the Hotchkiss guns.

In the event the Canal du Nord was overcome without much difficulty, although the American battalion lost about one-third of its tanks on a forgotten British minefield. Thick mist inhibited progress in the early stages of the battle, but, with a few unfortunate exceptions, the results of the day's fighting were deemed to be

One of the more improbable experiments involving a Mark V was this one where the tank was rigged to haul a train of fuel barrels that clearly had minds of their own.



successful. Even so, the attrition rate had been high: one history records that by 11 October 819 tanks had been turned in for salvage.

As a result tanks took only a relatively modest part in the final operations of the war. With the Hindenburg Line now essentially broken the fighting entered a new and more mobile phase, which was beyond the powers of the Mark V to sustain. Where the Germans established themselves in fixed defences, a few tanks were rallied to attack. Cribs were used again when an attack was launched against German positions behind the river Selle, and as the weather turned more autumnal mist often blanketed the battlefield. At times such as this tank crews began to appreciate the advantage of having a compass, which one battalion commander had already commented upon. It also appears to be the case that in open country tanks often went into action without unditching beams, which was regarded as a mistake.

There were instances of fatalities, caused by unditching beams breaking loose, sliding forwards as the tank rolled downhill and crushing anyone protruding from the hatch in the front cab roof – usually the young officer in command. Instructions were issued to prevent this practice, but accidents will happen. Photographs exist of trials, carried out at Dollis Hill in north-west London, with a Mark V* female tank on which sulphonic acid was introduced into the exhaust system to create an effective smoke screen. It is claimed that this was used in action during the second battle of Cambrai late in September 1918, although no detailed reports have been found.

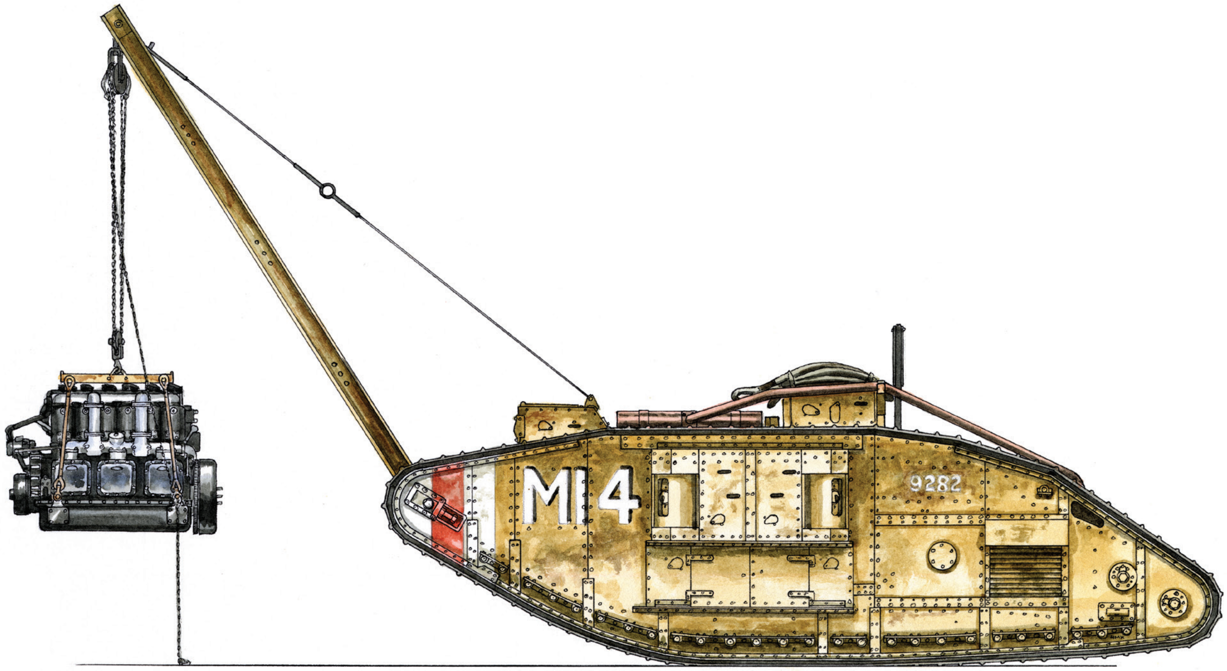
It is fashionable at present to dismiss or play down the value of tanks in World War I, but this does not seem to have been the case at the time. In the weeks leading up to the Armistice German troops were often quick to surrender, or abandon their positions, if tanks appeared. British and Commonwealth commanders remarked that infantry who had been into action with tanks were subsequently reluctant to go into action without them, and Field Marshal Sir Douglas Haig, in his final despatch of the war said:

> It is no disparagement of the courage of our infantry, or the skill and devotion of our artillery, to say that the achievements of those essential arms would have fallen short of the full measure of success achieved by our armies had it not been for the very gallant and devoted work of the Tank Corps, under the command of Major General H J Elles.

AFTER THE ARMISTICE

In the final months of the war the French army received 100 Mark V* machines comprising 87 males and 13 females, but how much use they got, if any, is not clear. At least one male machine, with its guns removed and the sponson apertures blanked off, was still around in 1940. It was turned into a strongpoint, with dozens of sandbags stacked on top, but it was not a mobile one and presumably lasted no time at all when the Germans arrived.

American demands were much more modest; they asked for only five machines – two male and three female – to be shipped across to the USA. The matter was raised and approved early in September 1919 and the correspondence implies that they went soon after. One of them, a male tank and the only example of a Mark V* to survive anywhere, is now in the Patton Museum at Fort Knox, Kentucky, albeit without its guns. A year later a plan seems to have been mooted to sell 27 Mark V* to Spain, although there is no evidence to suggest that this was ever done.



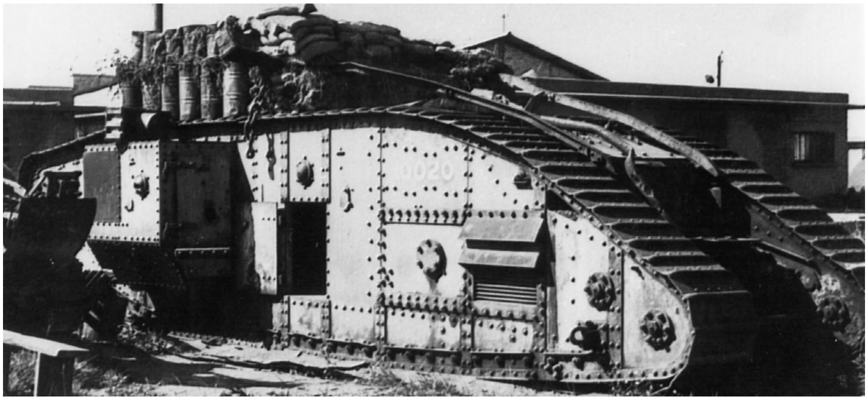
MARK V FEMALE TANK WITH PORTABLE TANK CRANE, GERMANY, 1919

The Portable Tank Crane was a standard attachment for all Mark IV and V tanks. It was bolted to the idler shafts on the inner face of the horns and stayed, by wire rope and chain, to the top of the driver's cab. It was operated from the ground by a manual chain hoist. Battalions stationed in Germany after the war all had one and it seems to have been almost a permanent attachment on one tank.

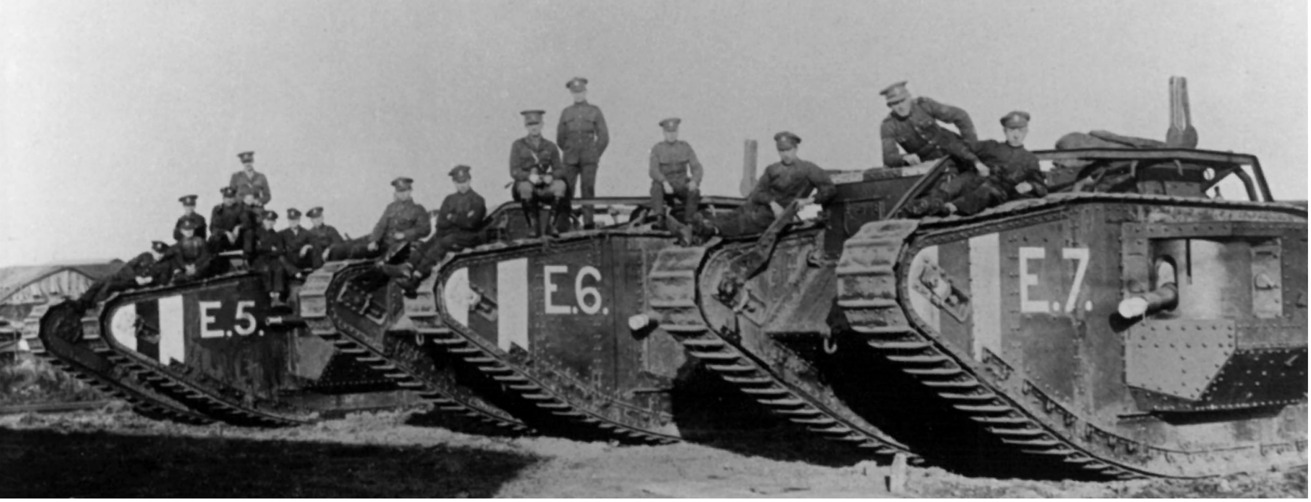
The illustration shows a female Mark V of 13th (M) Battalion in Brigadier General H.K. Wood's 5th Tank Brigade, part of the Army of Occupation in Germany in 1919.

The crane could be used to lift and replace heavy components during tank maintenance in the field and was perfectly capable of lifting a Ricardo 150hp engine out of a tank and carrying it, without upsetting the balance of the tank. However, the process also involved unbolting and removing a large segment of the roof. (Art by Henry Morshead, © Osprey Publishing)

The rump of the organization that developed and supplied tanks during the war hung on for some time afterwards, finalizing experiments already being conducted. Most of these involved tanks dealing with mines and wire entanglements, but did not necessarily involve Mark V machines. One that did involved attempts to tow drums of fuel by means of a harness, which was hopefully a lot more efficient than it looks.



Surviving Mark V* tanks in French service were turned into infantry strongpoints in 1940. The guns were removed and the tanks themselves immobilized, but they were a forlorn hope in the face of the German onslaught.



Social unrest following World War I gave rise to a number of major strikes of which the 1920 Coal Strike was one of the first. Tanks, particularly heavy tanks, are not ideal for maintaining law and order – they are too heavy handed – but these Mark Vs of 5th Battalion were photographed in Liverpool on such duty.

But there is one experiment that, had it worked, might have revolutionized tank development in Britain at a remarkably early date.

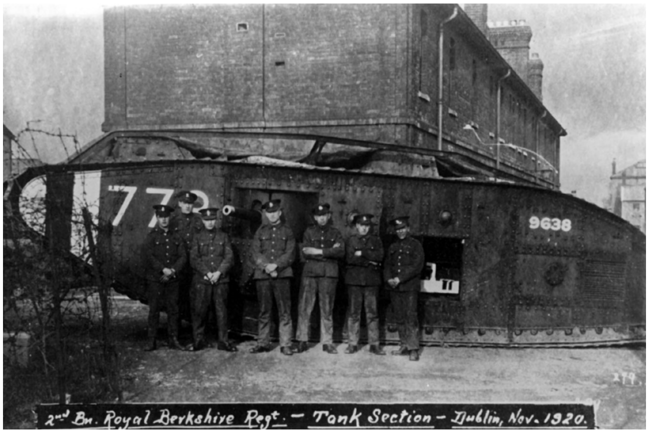
It was the result of the ingenuity of two men, both Tank Corps officers whose expertise lay in different but complementary fields. One was Colonel J.F.C. Fuller, reckoned a genius by many of his contemporaries, whose Plan 1919 advocated a swift end to the war with rapidly moving tanks that had not yet been invented. Major Philip Johnson was a Tank Corps engineer, extremely competent and inventive, but blessed with a highly imaginative approach to tank technology. He was charged with developing a tank to meet the requirement of Fuller's Plan, although common sense would say that none of this could possibly be ready for 1919.

Following earlier, more pedestrian experiments involving tanks with springs and powerful engines, Johnson allowed his imagination to run away with him, with ideas based upon the flexibility and high-tensile strength of wire rope, as used on heavy-duty ploughing engines of the period. In Johnson's scheme wire rope would not only form the core of laterally flexible track, it also became the main medium of suspension attached to a few springs instead of a multitude. A Mark V female machine, No. 9425, shorn of its sponsons and other armoured panels, was fitted with Johnson's track system and a Ricardo 225hp engine. Much of the work was done by John Fowler & Co. of Leeds, experts in the design and construction of steam ploughs and Johnson's pre-war employer. Completed in May 1919 it was demonstrated to an august audience in Roundhay Park, Leeds, where it disgraced itself by showering the audience with detachable track shoes and no doubt by its unkempt appearance. Even so it achieved a top speed of 20mph, which was not bad for a Mark V. Johnson went on to develop a family of bizarre tanks from this odd prototype, while 9425 was retired to the original Tank Museum collection at Bovington, although it was later scrapped.

With the ending of the fighting in Europe the victorious Allies decided to create enclaves in the western part of Germany in order to enforce the peace and encourage the Germans to agree to unconditional surrender. The British occupied an area around Cologne for which they coined the term British Army of the

BANK FÜR HANDEL UND INDUSTRIE

Citizens of Cologne, more intent on getting out of the rain, ignore a pair of tanks from E Battalion sitting in the middle of the square. But it was a useful reminder of just who was in charge at that time.


772
9638
279
2nd Bn. Royal Berkshire Regt. – Tank Section – Dublin, Nov. 1920.

This photograph, taken in Dublin in November 1920, shows seven men belonging to the Tank Section of 2nd Battalion The Royal Berkshire Regiment. Whether they were the tank's crew or infantry passengers is not clear; the regimental history does not mention tanks at all. However the idea of manoeuvring such a big tank around the streets of Dublin seems daunting.

Rhine. To begin with the Tank Corps element was represented by armoured cars, but in March 1919 two brigades, formed from five battalions, were added to GHQ reserve in Germany to be mobilized in case of trouble. A year later demobilization had reduced this strong force to a single battalion (12th), itself much reduced, based at Solingen and called the Rhine Army Tank Company.

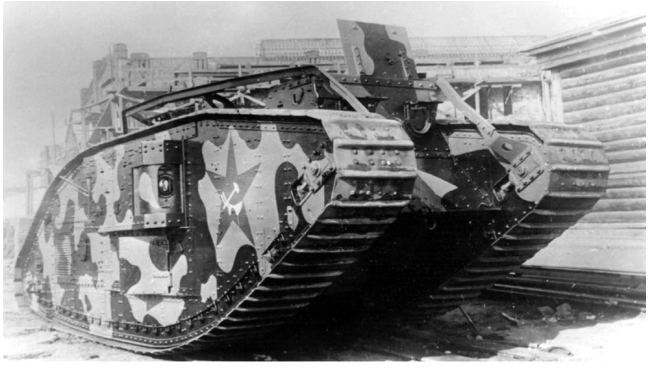
As they came home from France the remaining battalions were reduced to cadre strength and ultimately disbanded, although from September 1919 onwards five battalions were recreated, four of which operated Mark V tanks until more modern types came along. Ultimately only 1st (Depot) Battalion at Bovington and the Tank Corps Gunnery School at Lulworth retained any of these tanks and they were mostly used for stunts. Social and industrial unrest in the early 1920s called the tanks out for more serious duties; a detachment equipped with Mark V* tanks was sent to Seaforth near Liverpool and at least one Mark V was seen on the streets of Glasgow around the same time.

In Ireland some Mark V* tanks were based in Dublin, initially as part of 17th Armoured Car Battalion, but there is evidence, of a sort, suggesting that some tanks were operated by infantry battalions. However, work of this kind was better suited to fast and quiet armoured cars than clumsy tanks.

Meanwhile back in Germany tank strength was down to a single company which, when it was not on active service, occupied a cavernous Zeppelin hangar at Bickendorf near Cologne. In fact, active service normally involved ceremonial parades or 'hearts and minds' events to win over the local population; although in April 1920 one section of tanks was sent to Brobeck to intimidate a hostile crowd and remained there for two years. The last British tank force in Germany was B Company of what was now 3rd Battalion Royal Tank Corps, which withdrew from Cologne in January 1926.

A number of British tanks served in Russia during the Civil War period. The first of these, the South Russian Tank Detachment, went direct from Erin, in France and landed at Batun (Batumi) on the Black Sea; it was equipped with Mark V and Medium A tanks, 74 in all. In July 1919 another detachment, bound for Estonia and north-west Russia, was formed at Swanage, but had only a handful of tanks, while four Mark V and two Mediums were supplied to the North Russian Tank Detachment that left Wareham in August 1919. They were there to guard the port facilities at Archangel, while the role of the other two was ostensibly to train the White Russians on how to operate British tanks. A fruitless task since the rank and file were so petrified of the Bolsheviks that they deserted or defected at the first opportunity.

By the summer of 1920 all the British troops had left and the tanks ultimately fell



This tank, photographed outside a military establishment in Moscow in 1921, has been refurbished and repainted for Red Army service. A number of these tanks were still functioning in 1931.

Lined up alongside this muddy Mark V** male are, from the left: Harry Buddicom, W.G. Wilson, Harry Ricardo, Lieutenant Shaw (in naval uniform); the names of the other three, and the dog, are not recorded.

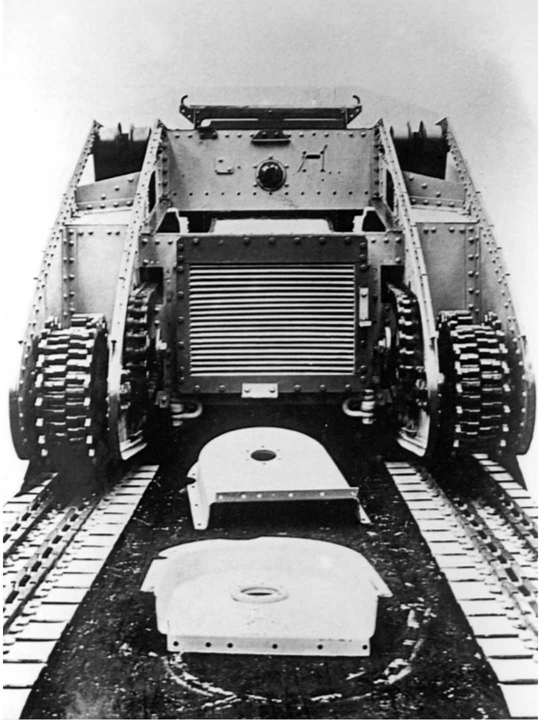
into Soviet hands. They were known to the Red Army as Rikardos on account of their engines, and records show that in all 59 were acquired and put into service. The last of these were withdrawn as late as 1938, although how the Russians kept them running so long is an impressive mystery. It appears that four Mark V tanks in Estonia, still in working order, sallied forth in defence of Tallin in August 1941. Photographs show hermaphrodite or composite Mark V tanks apparently armed with Soviet 45mm tank guns in their male sponsons and water-cooled Maxim machine guns on the female side. They are reputedly ex-Estonian tanks, left behind by the British and subsequently taken over by the Russians who rearmed them for further action.

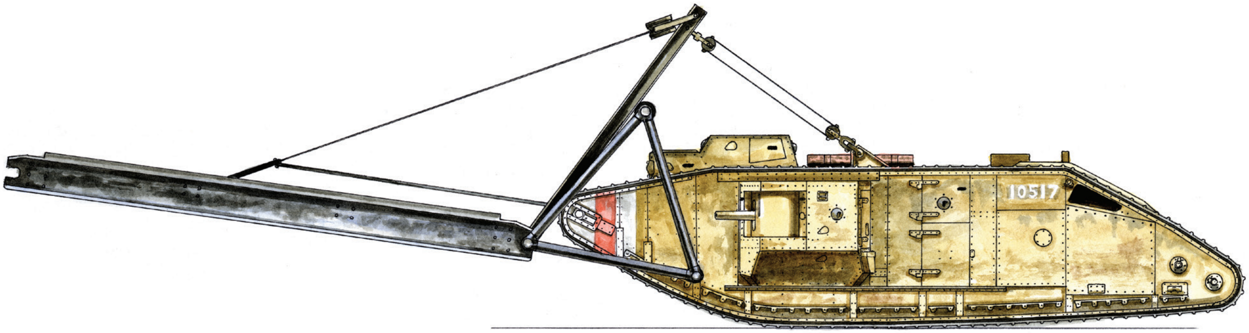
THE MARK V**

The ambitious programme outlined above for 900 tanks never bore very much fruit. None of these tanks had been delivered at the time of the Armistice and in the end only 25 were completed. However it does raise a number of interesting issues. In the first place it is an indication of the progress that had been made in the tank construction industry that any firm, even a big firm like Metropolitan, could accept orders for so many tanks (in addition to about 400 of other types) at this stage in the war. It suggests a considerable expansion in manufacturing capacity and workforce. It also reveals considerable faith in the future of the tank within the British military establishment, for we must realize that when these massive orders were placed there was a firm belief at all levels that the war could continue into 1919. Then, of course, there was the potentially better International, or Mark VIII design, first mooted in December 1917; another factor was that by the time the first Mark V** was ready the fighting had ended and the requirement for longer tanks to tackle wide trenches had diminished.

The designation Mark V** (or two-star) indicated adaptations to an existing design, although in many respects the V** could safely be described as a new tank. The basic shape was revised, making the tank rounder and fuller at the front; the lower profile of the hull frames had been changed to make the long tank easier to steer; and Harry Ricardo had produced a more powerful version of his six-cylinder tank engine, which delivered 225bhp at 1,250rpm. By locating the engine further back inside the tank the centre of gravity was improved and a greater area of free space created at the front. The Mark V** was the same length and width as the Mark V*, but a few inches

This rear view of a Mark V** shows how the final drive was modified with the chains located on the inner faces of the frames and the gears that meshed with the sprockets.





MARK V** MALE ENGINEER TANK WITH CANAL LOCK BRIDGE, EXPERIMENTAL BRIDGING ESTABLISHMENT, CHRISTCHURCH, 1919

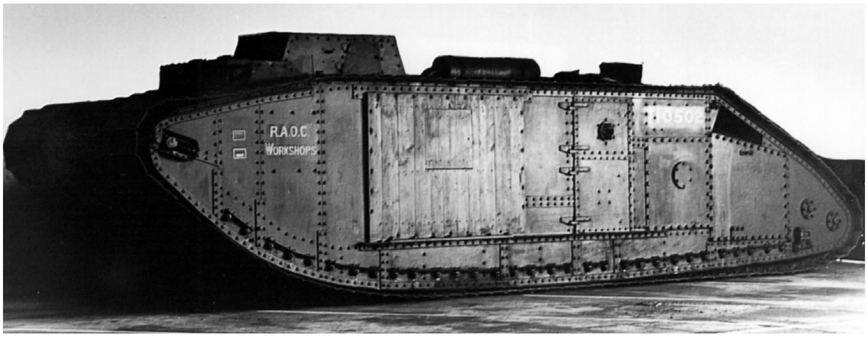
Shortly before the Armistice in 1918 three Tank Bridging Battalions were formed at Christchurch – then in Hampshire, now in Dorset – but they were soon reduced to an experimental company under command of the then Major G. le Q. Martel, Royal Engineers. Their experimental work involved the design of a portable girder bridge that could be carried and laid by a tank, capable of bridging a standard European canal lock, which was 20ft wide.

Much of the design work was carried out by the renowned bridging expert Major C.E. Inglis. The weight of the bridge and its launching apparatus, all concentrated at the nose of the tank, was best balanced by the length and mass of the big Mark V** machines.

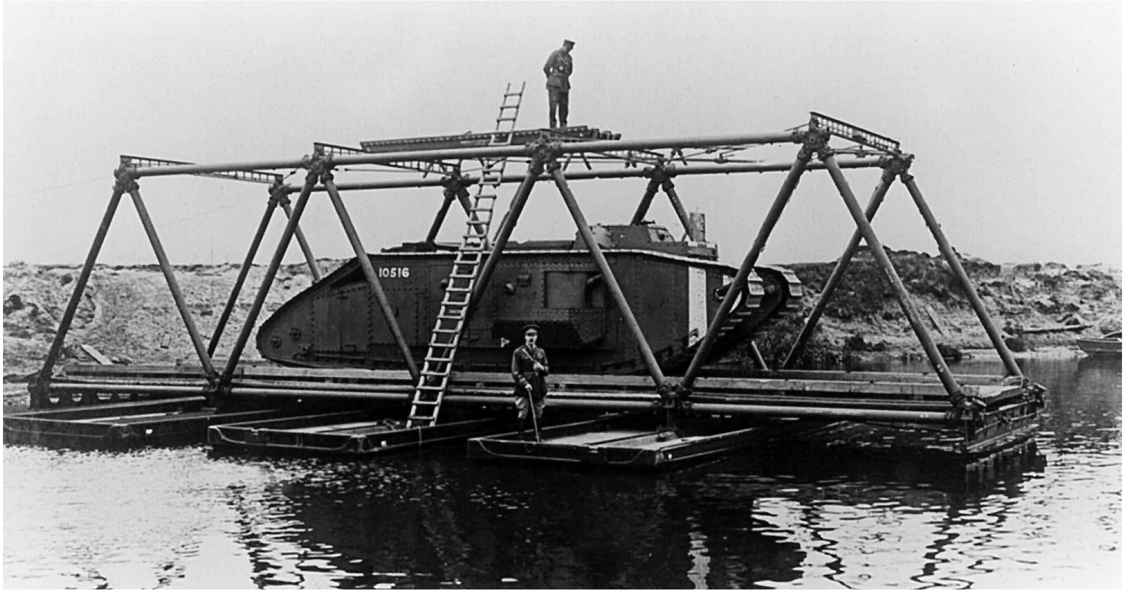
The illustration shows an interim design that used a manual winch to raise or lower the bridge, and it was this type that took part in the 1920 Royal Tournament display in London. In due course an improved version, using a hydraulic system, was introduced and the range of functions increased, resulting in the multi-role Royal Engineer Tank, a forerunner of the World War II AVRE. (Art by Henry Morshead, © Osprey Publishing)

taller because the rear command cab had been moved forward and superimposed on the driving cab. There were also major revisions at the back. The radiator and fan occupied a rear extension of the hull while the fuel tanks were relocated within the track frames, but well away from the crew area. This arrangement improved ventilation throughout the tank, but also required that the final drive chains were moved inboard, to the inner faces of the track frames.

Machine-gun positions were installed in the rear of the hull and in both ends of the enlarged commander's cab and in the full-height side doors. Otherwise, in terms of armament and sponsons the Mark V** was identical to its predecessors. It is also worth remembering that by this time a lot of investigations were in progress, both in cooperation with friendly aircraft and defence against attacks by enemy planes, which was reflected in the design. For example, there were more roof hatches and at least two of the machine guns had some potential anti-aircraft capability.



This Mark V**, with sponsons removed, was fitted with a Beardmore Type 6/1 four-cylinder diesel engine and sent to the Mechanical Warfare Experimental Establishment in August 1927. No records survive of its performance beyond saying that the engine developed 320hp. It was disposed of in 1933.



Mark V** tanks were mostly associated with the Royal Engineers at Christchurch after World War I. This male tank is being ferried on a raft made from pontoons and a section of Inglis bridge.

At 35 tons the Mark V** was slightly heavier than the V*, which resulted in increased ground pressure, but the new tank was a bit faster than the V* and, since it had a more powerful engine, unditching gear was not considered necessary. Some accounts speak of improved internal communications in the form of speaking tubes and wire-operated range and direction indicators for the gunners. This may be so, but the fact that most of the crew, apart from the rear machine-gunner when he was in place, were all clustered at the front must have improved the situation anyway.

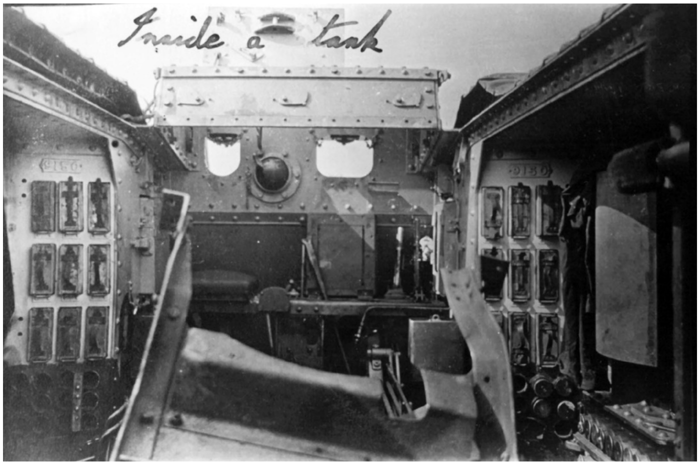
Doubts about the availability of the Mark VIII, due to the perceived risk to the supply of Liberty engines crossing the Atlantic, caused the order for the additional 600 Mark V** to be placed, although of course it was never fulfilled. At the time of the Armistice the Saltley factory found its contracts being cancelled until, in the end, just 20 male and five female machines were completed.

As late as 1928 the Royal Army Ordnance Corps released a Mark V** (T10502) for experimental purposes. It was fitted with a Beardmore 400hp diesel engine and tested at the Mechanical Warfare Experimental Establishment in 1929. The engine itself seems to have performed adequately, but the starting engine that came with it failed, and while this was being repaired the decompressor, which made the main engine easier to turn over, was modified. All of which, in the long run, seems to have been a complete waste of time; once it was running again the big diesel vibrated so much that it almost shook the tank, and the crew, to bits. Fumes from the fuel also affected the crew so the trials were halted. There is no evidence that they were ever started again.

DEVELOPMENTS AT CHRISTCHURCH

During the Napoleonic Wars a barracks had been established near Christchurch Harbour in Dorset, close to the point where the river Stour and Hampshire's river Avon meet. In 1918 this had been taken over by the Royal Engineers, the proximity of the rivers having great significance.

The reason for this may be traced back to 1917 and in particular the battle of Cambrai. Operations there had shown that while canals could provide secure protection



At the end of the war many tanks were scrapped, although it would be unusual to do this with ammunition still in place. This is the interior of male tank 9150 shown with its engine and roof plates removed, providing a fascinating view looking forwards.

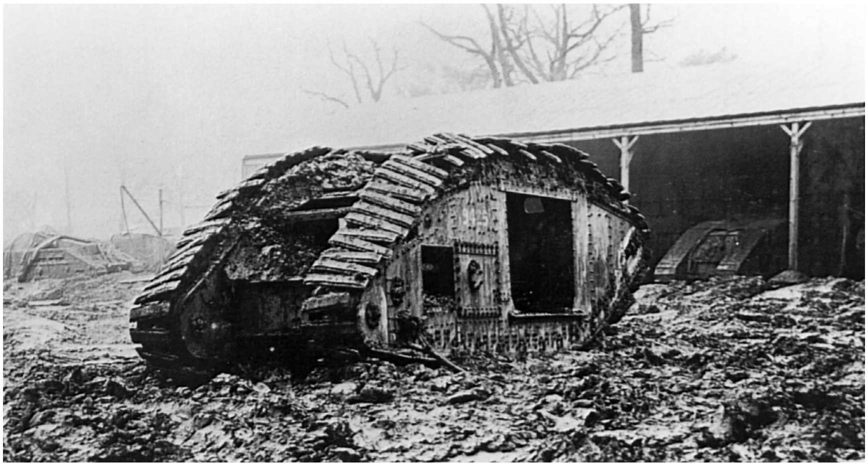
for the flanks of an attacking army they could be a serious obstacle to tanks and, to a lesser degree, other attacking arms. In order to sustain the momentum of an attack it was imperative that obstacles such as canals should not hold up proceedings for a moment longer than necessary, so a bridge was required, which a tank could carry and lay under fire, to enable other tanks to cross. Also, for 1918, a requirement had been foreseen for some sort of lightweight bridge that could be used to enable lighter tanks, such as the Medium A Whippet, to cope with wider trenches that the longer, heavy tanks could take in their stride. These two appear to have had a common origin.

The towed bridge was a simple affair of two heavy-duty girders, each something over 20ft long, arranged parallel and spaced at the width of a tank's tracks, braced by lighter cross members. The bridge was towed behind a longer tank (for example, a Mark V*) like a sledge and released when it spanned a wide trench. The towing tank could now go on its way, while following Whippet tanks, driven with care, used the bridge to cross the trench. Since the span of the average lock on the French waterways was also 20ft, with firm abutments on each side, it was clear that the same type of bridge could be used there too. In most cases the approach to a lock from the side was quite easy, so they would make excellent crossing places. But in this instance the idea of towing the bridge was impractical; it would have to be launched from the front of the tank.

Experimental work was undertaken at Tank Corps Central Workshops in France, probably under the direction of Major G. le Q. Martel, the Brigade Major at Tank Corps headquarters, but also, of course, an inventive Royal Engineer. There is some evidence that a number of similar experiments were taking place at Dollis Hill in London.

In February 1918 it became clear that the scale of this work was beyond the limited resources of Central Workshops, so the engineer-in-chief called in one of the leading bridge designers of the day, Charles Inglis, then serving as Major C.E. Inglis RE. Inglis had already been responsible for the design of a range of prefabricated military bridges, assembled rather like scaffolding, but none so far strong enough to support tanks. He started work on what became known as the 21-foot Canal Lock Bridge, but whether this work was carried out in Britain or in France is not clear. Christchurch was taken over in October 1918 when the need for tank bridging was becoming critical, and it became home to three Royal Engineer Tank Bridging Battalions. The plan was to equip each battalion with a dozen of the new Mark II Inglis bridges, which were capable of supporting tanks, and 48 tanks equipped to carry and lay the 21-foot Canal Lock Bridge.

Of course it is one thing to make these plans, and quite another to have the right equipment available in sufficient quantities to implement it. But in any case much of the urgency went out of the programme when the Armistice came into effect in November 1918. Martel had already been notified that he would be commanding

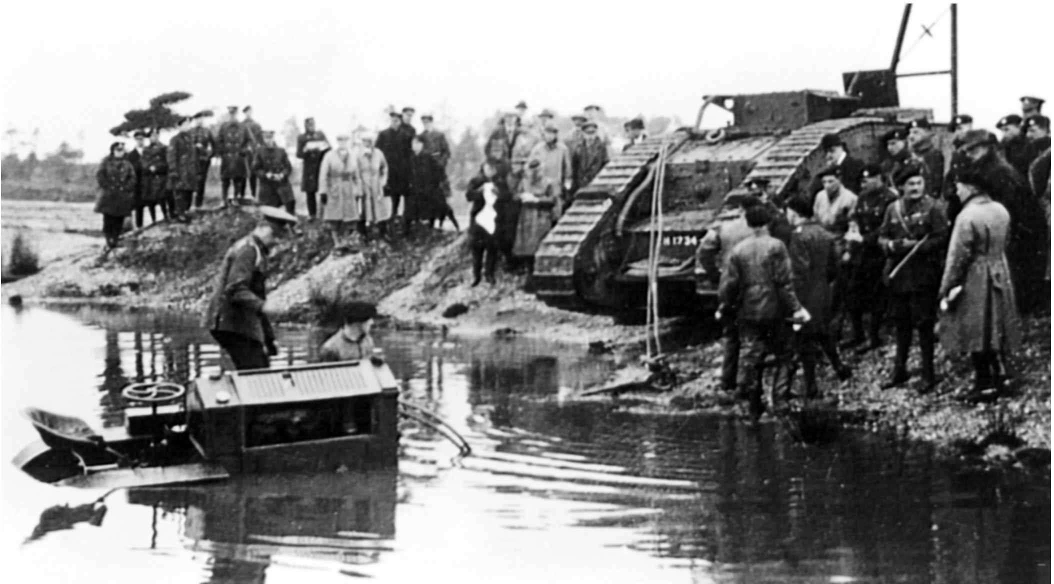


The modified Mark V female tank with Johnson's flexible steel-wire rope-suspension system and tracks, photographed upon a sea of mud at Dollis Hill, north-west London, before it was moved down to Bovington and ultimately scrapped.

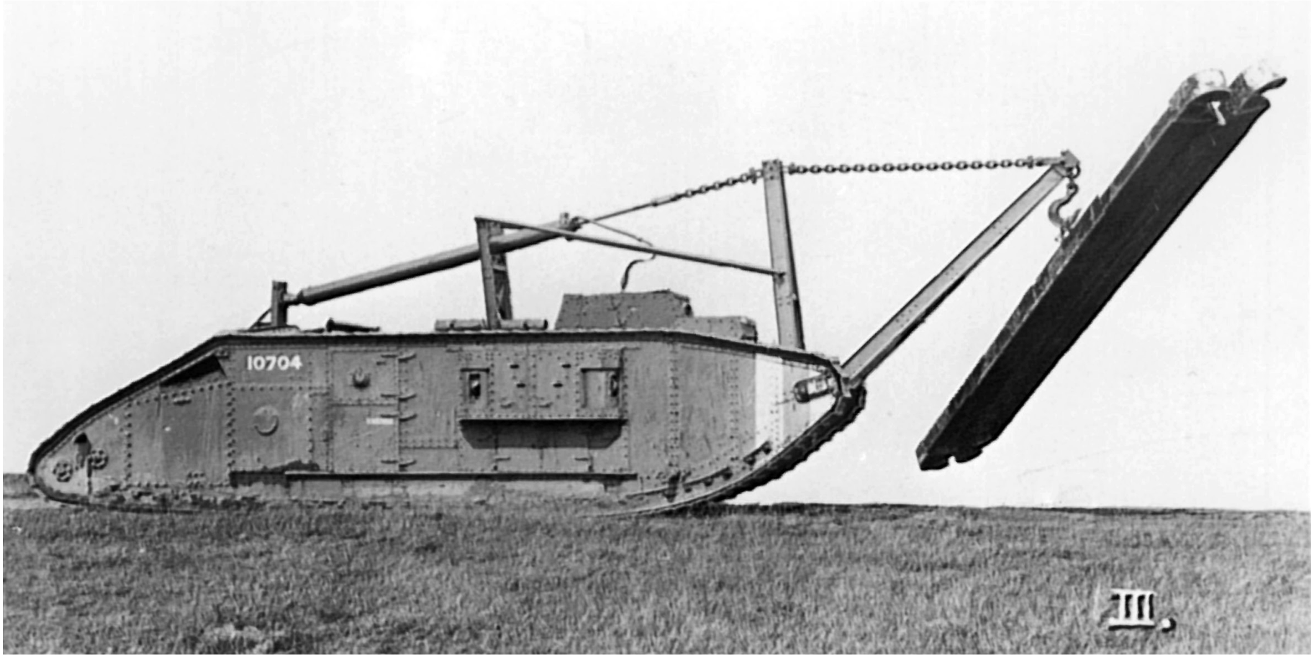
one of the three RE Tank Bridging Battalions, but in February 1919 this ambitious project was reduced to an Experimental Bridging Company RE, still with Martel in command but a much reduced staff and equipment.

From surviving photographic evidence it seems that the first tank to be adapted to the role of bridgelayer was Mark V* male tank 10264, which was photographed tackling an artificial lock at Christchurch in what was probably the winter of 1918/19. It has a pivoting, triangular framework at the front, raised and lowered by a block and tackle system, and a manually operated winch behind the rear cab. Thus in order to operate this bridge it would require at least two men to leave the tank and work on top, which was hardly satisfactory, but this was probably the first test rig. The same arrangement is shown in a sequence of drawings that appeared in *Weekly Tank Notes* of 24 May 1919. However by the summer this system had been transferred to a Mark V** tank, which appears to have the winch installed inside the vehicle. This took part in a public demonstration at the event that we now know as the Royal Tournament.

The evidence available, in terms of materials as much as anything else, suggests that up to this point the work was in the hands of Inglis, but in due course, as the urgency diminished, it appears that Martel must have taken over. As an officer with considerable experience of tanks Martel seems to have had a poor opinion of the manual method employed to raise or lower the bridge, his argument being that as a



An incident from the 1925 Wool Trials; a Burford Cletrac tractor has drowned and is being rescued by a Mark V acting as a recovery vehicle. It is fitted with a portable tank crane at the front.



The final variant of the RE Tank is illustrated by this Mark V** female (now in the Tank Museum collection), which used a hydraulic pump to activate the lifting arms for a variety of functions including the crane shown here.

machine the tank ought to be able to relieve its crew of any physical work. To this end a Mark V** female machine was equipped with a new kind of lifting apparatus that employed hydraulics instead of the manually operated winch. A Janney hydraulic pump was installed, driven off the tank's engine. This, via a massive hydraulic cylinder and two sturdy jibs, could handle the bridge without anyone having to leave the relative safety of the tank. Of course, there was a lot of prominent and vulnerable top hamper on the roof of the tank, but no doubt further designs could have modified this. In the event this is as far as this work went, although it had expanded in other respects.

The Mark V** with the hydraulic jib was known as the RE or Royal Engineers Tank and, like any good sapper, it could turn its hand to other work. Used as a field crane the tank could lift payloads of up to 15 tons, sweep mines by trailing a pair of heavy rollers from the jib, or place and detonate an explosive charge at the end of a long jib for demolition tasks. With this versatility it was a forerunner of the Armoured Vehicle Royal Engineers (or AVRE) of World War II and after.

The other bridge mentioned above, the Inglis Rectangular Bridge Mark II, was not carried or laid by a tank, except in one exceptional instance, but it was capable of supporting a heavy tank over an obstacle. With a length of 105ft it could be used by a 35-ton tank to pass across a 100ft gap. Sections could be linked together to bridge wider gaps, up to 450ft, but only at water level because the central sections had to be supported on floating pontoons. For wider water obstacles (and the British Army had the river Rhine in mind at this time) sections of bridge, resting on pontoons, could be created to carry tanks as a sort of ferry. This was a concept that was resurrected when the Rhine actually had to be tackled in March 1945.

The exception mentioned above was the Inglis Assault Bridge, a 135ft Inglis Mark II supported on a set of dumb tracks not unlike the track frames of a Whippet tank. This structure would be assembled as near to the crossing point as possible and then pushed into place by a tank. The special RE Tank is normally associated with this work, although there seems to be no reason why any tank could not have moved it if required. The bridge would be pushed across the gap until it reached the far side, by which time the tracked carriage would be on the point of dangling in the gap. Once it was finally in place the tank would detach itself and cross over. Again, this impressive arrangement reappeared, in improved form, in World War II.

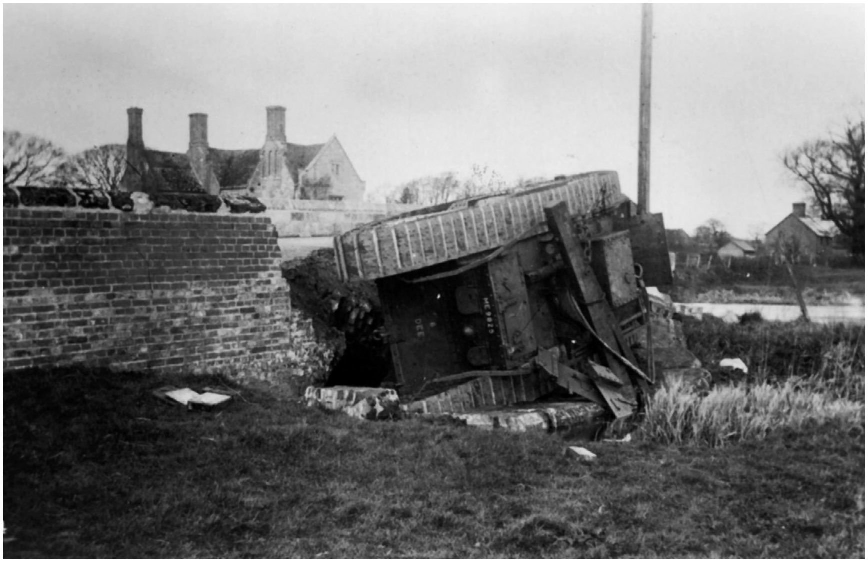
Other experiments carried out by Martel's sappers at Christchurch included one connected with a Mark V type. This involved the tank towing a heavy-duty Fowler balance plough – a huge, double-ended thing normally hauled to and fro by a pair of steam ploughing engines. This cut a deep, albeit straight trench that could then be improved upon by the infantry. A smaller device known as a Mole Plough, normally used to create drainage tunnels, could also be used to lay signal cables underground.

It is always the way in war; just as the level of inventiveness reaches its peak the requirement fades and interest diminishes.

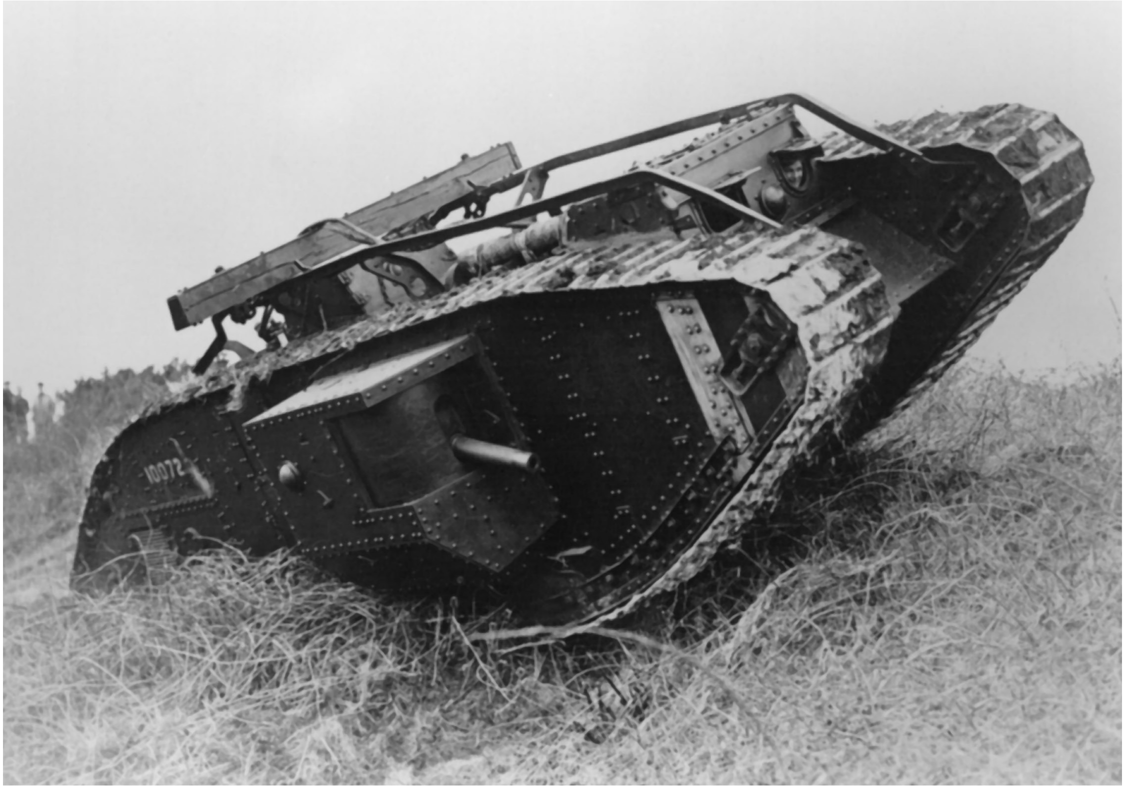
THE MARK X

Events moved fast in the last months of the war. Soon the troops and tanks had advanced beyond the wide and complex trenches of the Hindenburg Line into open and relatively unspoiled country. As a result things changed. There was no further need for longer tanks such as the Mark V* or even its proposed successor the Mark V**. Now there was considerable demand for more of the faster, manoeuvrable Mark V machines and in August 1918 a new order for 2,000 was placed with Metropolitan, apparently on the condition that the firm would not be expected to undertake too many modifications or improvements. That was a forlorn hope. Wilson, as we have seen, was already making changes to the ventilation system in order to improve conditions for the crew, and it had also been agreed that a number of the loopholes and pistol ports would be eliminated. But Central Workshops ultimately came up with a list of 62 other modifications, small things in themselves, but the cumulative effect was to cause Metropolitan to reject the work.

It was Stern, in the end, who managed to get the programme back on track by persuading Metropolitan to change its mind, but in order to justify this it was agreed to treat it as a new tank. Under the existing system it should have been classified as



Dee of 4th Battalion crashed off Wool Bridge en route from Bovington to Lulworth in 1924. An ancient notice attached to the bridge warns anyone who damages it that they are likely to be transported to the Colonies for life.



The Amir Amanullah of Afghanistan visited Bovington and Lulworth in March 1928 and was treated to a display by a couple of Mark V* tanks. It was a surprising choice and surprising to find them still in good condition ten years after the war. Did they hope to sell some?

Mark V***, but this was seen as a clumsy arrangement likely to cause confusion, so the designation Mark X was adopted instead. Outwardly it would look like the original Mark V and be powered by the same engine, but, since none were built and no drawings appear to have survived, it is impossible to say exactly what it might have looked like.

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The life of the average tank in 1918, like that of the butterfly, was ephemeral. A moment or two of glory on the battlefield, a year or two on dull garrison duty and ultimately the scrapheap.

In 1928 King Amanullah, the Amir of Afghanistan, visited Britain and among other locations was brought down to Bovington and Lulworth. At the latter site he and his entourage were treated to a demonstration by two Mark V* male tanks, but whether this was just a show to keep him amused, or a scheme to supply some to his country, is by no means clear. It is surprising enough to find any of these tanks still in operational order ten years after the Armistice, but the idea that they might have been suitable for service in a country like Afghanistan is laughable.

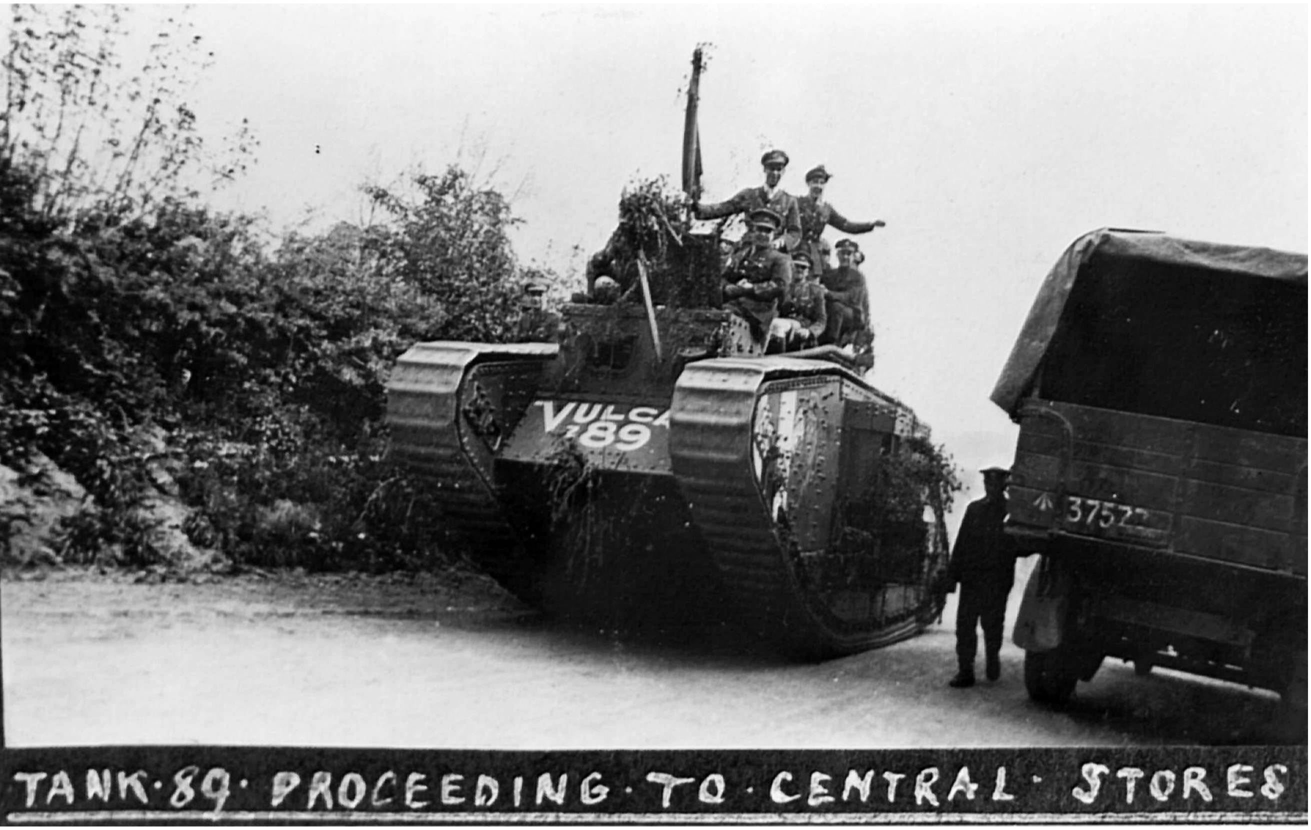
However at least one anonymous Mark V seems to have proved to be a survivor. Damaged in action on a battlefield in France in 1918 it was subsequently removed to Tank Corps Central Workshops for repair. When it emerged in 1919, as good as new, it had been transformed into a composite, or hermaphrodite tank with a male sponson on one side matched by a female sponson on the other.

In this form it accompanied the British South Russian Tank detachment to the

Black Sea and was used to train the White Russian army in its struggle against the Bolsheviks. This having failed, the British troops withdrew and the surviving tanks were absorbed into the Red Army, which they served for many years between the wars before being retired.

Our tank was one of two presented to the city of Smolensk shortly before World War II and parked outside a public building like venerable sentinels. Smolensk was occupied by the Germans, who, in due course removed one of these tanks back to Berlin where it was photographed in 1945; probably the only Mark V ever to fall into German hands. Even so by that time Berlin had fallen to the Russians who, whether they knew it or not, recaptured one of their own. What became of it after that is uncertain, but it was a long and adventurous life for one World War I veteran.

Between February and May 1919 Central Workshops refurbished up to 90 Mark V tanks, including conversion to composite, or hermaphrodite, type, but whether for Russia or Germany is unclear. The artwork on this tank was the work of Lance Corporal Planck, a cartoonist on the magazine *Punch* in civilian life.



Wm FOSTER & Co Ld
ENGINEERS
LINCOLN

CHAPTER 5

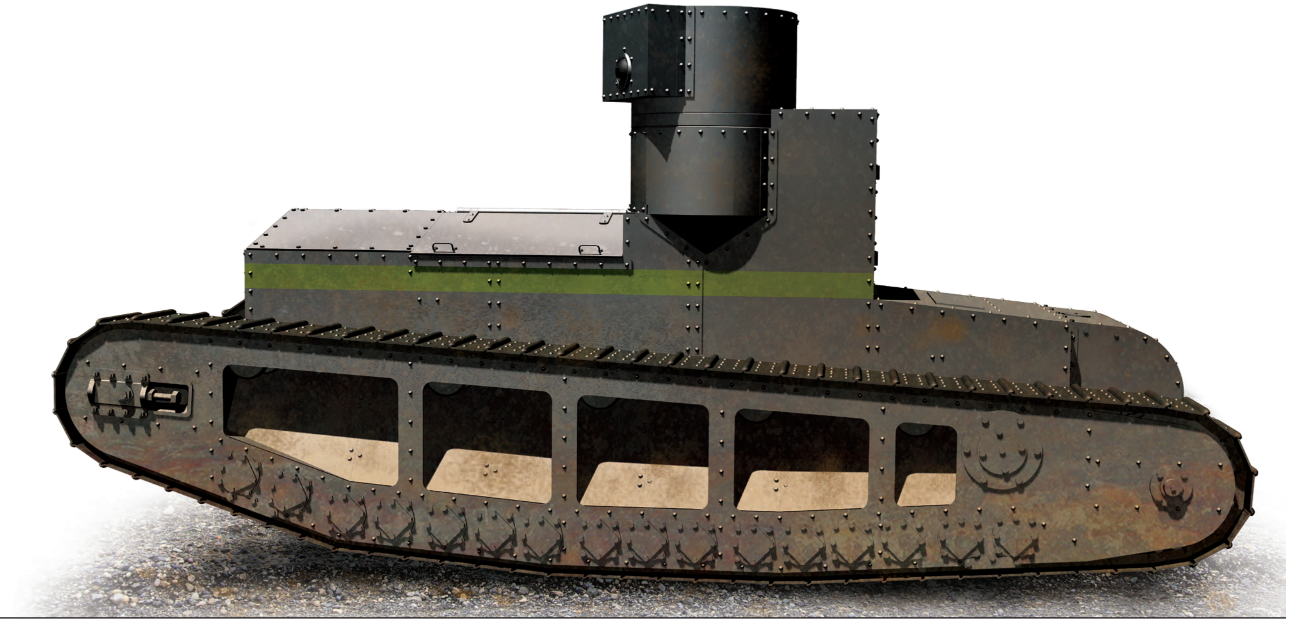
MEDIUM MARK A WHIPPET

THE TRITTON CHASER

According to the engineer William Tritton, he was asked to produce a lighter tank when he visited the Somme on 20 September 1916. This was only five days since tanks had been launched onto the battlefield for the very first time. Tritton does not say who requested this, but the implication must be that it was Sir Douglas Haig, Commander-in-Chief of the British Expeditionary Force (BEF), either directly or through his staff. No matter who was responsible, it was either remarkably prescient or a very lucky guess. It is valid to ask whether the idea of a faster, lighter machine was considered as an alternative to the slower, heavier tanks, or as an adjunct to them, which we have always assumed, but the fact that Tritton's design did not have the trench-crossing ability of the heavy tanks, and that improved versions of the heavy tank were developed, must support the adjunct theory in retrospect.

It is interesting to consider what fellow engineer Walter Wilson, another crucial contributor to the early tank, knew of all this. Given his close association with Tritton, and the fact that he was later appointed joint Director of Design for the Mechanical Warfare Department, it seems unlikely that he was entirely ignorant of developments. In a paper that appears to be dated towards the end of 1916, he speculates on future developments, including that of a light tank that, he says, would need only low-slung tracks and perhaps a turret. All of this suggests that he knew full well that Tritton was working on a lighter model, yet he says nothing at all about the driving system or transmission, which is odd bearing in mind that these were his areas of expertise. Perhaps he knew what Tritton was planning but elected to keep his opinions to himself. However, he also seemed to be aware of what Harry Ricardo was doing in terms of designing a more powerful engine for the heavy tanks, and implies, although he does not actually say so, that this engine would also be very effective in a lighter type of tank.

The story of the invention of the tank published by William Foster & Co. shortly after World War I, *The Tank: Its Birth and Development*, while largely company propaganda, is remarkably specific about dates. It states, for example, that design work on Tritton's light machine, later to be known as the 'Whippet', commenced on



TRITTON'S CHASER 'The Whippet' in original form

William Tritton was encouraged to design a faster, light tank when he visited the Somme on 20 September 1916, and the finished tank was ready to take part in the Oldbury Trials of 3 March 1917 in a suburb of Birmingham. The new tank was quite distinctive, with low-profile track frames, a small cylindrical turret on the left with a driver's cab alongside on the right. A green stripe was painted around the tank for identification purposes for the benefit of those attending the trial.

In its original form the Chaser was a two-man tank with a driver on the right and the gunner/commander in the rotating turret on the left, which was intended to carry a single .303in Lewis machine gun. It was driven by a pair of Tylor 45hp engines and was always a difficult tank to drive. With a top speed of over 8mph it was effectively twice as fast as a contemporary heavy tank and every bit as manoeuvrable, but it did not have a heavy tank's impressive trench-crossing capability. (Art by Henry Morshead, © Osprey Publishing)

10 November 1916, and that construction began on 21 December the same year. It has been said that Tritton based his design on the prototype machine 'Little Willie', but there is no hard evidence for this beyond the low profile of the track frames. Even so, this may explain a comment in an old Tank Museum publication that claims that Tritton first designed a light tank in 1915.

Foster's claim that the prototype was able to move itself by 3 February 1917 and embarked upon its first trial eight days later suggests that it was effectively complete, but the date that stands out in the Whippet's history must be 3 March 1917. On that day the Ministry of Munitions staged a demonstration of experimental tanks on a testing ground at Oldbury near Birmingham. Ostensibly arranged to try out a selection of experimental transmission systems in heavy tank hulls, the opportunity was also taken to introduce two experimental prototypes, the original Gun Carrier machine and what was now described as the 'Tritton Chaser'.

The programme that accompanied the event included a simple drawing of each tank and a reasonably detailed technical description, but the drawing of the Tritton Chaser has always been controversial. It shows the tank fitted with a small rotating turret, which, according to the description, contained a single Lewis gun. However, since every known photograph of the tank showed it with the more familiar angled superstructure, it has been claimed that the drawing was an early concept that had been changed before it was completed. Alas for such logical speculation, two photographs showing the machine with a turret, as in the drawing, subsequently surfaced, so there is no longer any need to speculate.

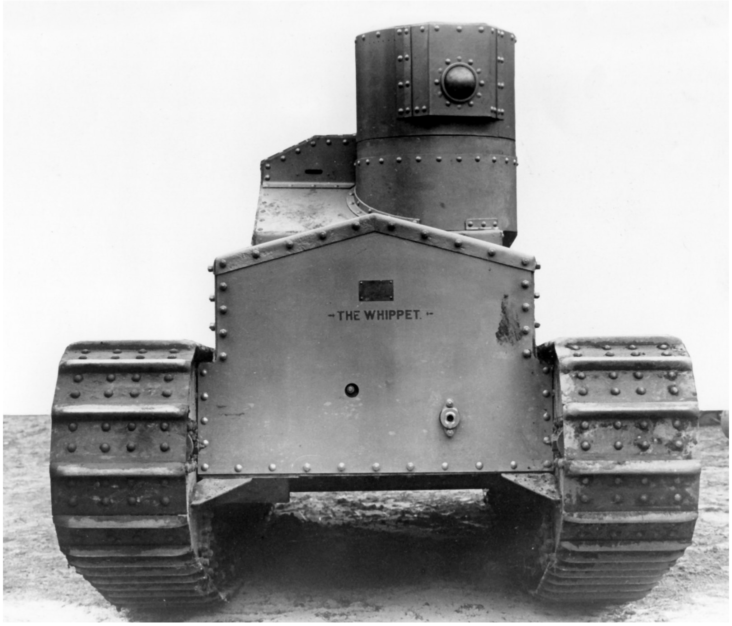
Although it is described as the Tritton Chaser in the programme, the caption beneath the drawing tells us that it is Tritton's Light Machine No. 2 (EMB). The names were interchangeable, although the former was more appealing. 'No. 2' was simply the tank's place in the display and should not be taken to suggest that it was Tritton's second design, while 'EMB' gives its official designation of 'Experimental Machine B', a system which appears to have been applied on an inconsistent basis. To make absolutely sure that the various tank models could readily be identified, each one (except for the gun carrying machine) was painted in a distinguishing colour. Exactly how this was done is again not entirely clear, but such evidence as there is suggests that it took the form of a broad stripe running around the hull about midway up. For the Tritton Chaser, the distinguishing colour was green.

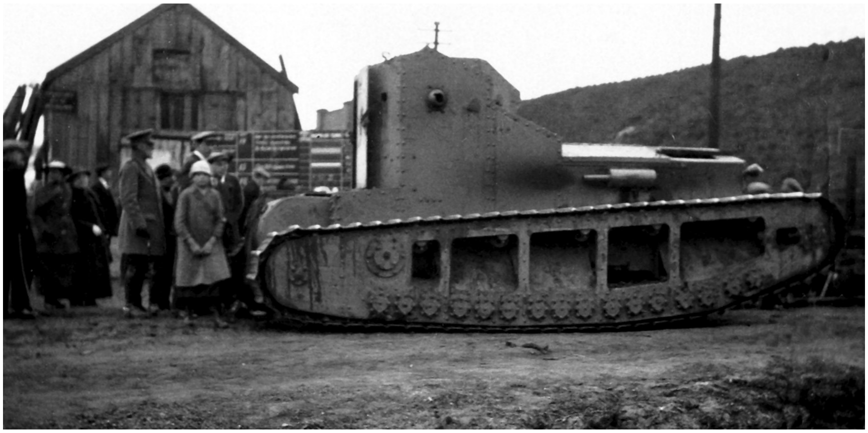
Since it is clear from the illustrations, there is no need to describe the outward appearance of the machine, but there are various notes in the Oldbury programme that might be expanded upon. The Tritton Chaser is introduced as an attempt to meet the requirements of the military authorities for a light machine capable of maintaining higher speeds than the standard type. So speed was the primary issue, suggesting perhaps a form of tracked armoured car. The paragraph ends with the simple sentence: 'Its twin engine transmission is worthy of note'. It is also clear from the Oldbury programme that at this time it was turreted, since under 'Armament' it states 'the armament consists of one Lewis gun in a gun turret'.

The mechanical arrangements of the Chaser are shown in the programme drawing and, since they are the same as in the production Whippet, can be treated here in some detail. At the front was a pair of 7,720cc Tylor JB4 45hp four-cylinder engines, normally running at 1,200rpm. Manufactured by the Tylor Company of King's Cross, London, they were typical of their day, with the cylinders cast in pairs, side valve and water-cooled. Single Tylor engines were fitted to the War Department's AEC Y Type 3-ton cargo trucks, and, perhaps more memorably, to late production versions of the legendary B Type double-deck bus of that era. Linked to a rugged four-speed and reverse gearbox, the engine produced a hard-wearing combination highly suited to a military vehicle, or indeed a bus.

The only modification required to get two of these engines alongside one another in a tank was that they were 'handed' i.e. the inlet and outlet valves on the left side engine were reversed so that the exhaust

The Whippet as first built with the offset rotating turret. Notice the socket for an engine starting handle and the very limited vision slit for the driver. At this stage the tank also had its fuel tank at the back, resulting in the square front end. Notice that a name, The Whippet, has also been painted on the front end of the tank.





The Whippet prototype in its second manifestation, with fixed superstructure and rear-mounted fuel tank. It was photographed at Foster's site at an unrecorded event. A surprising number of civilians seem to be present for what was supposed to be a highly secret demonstration.

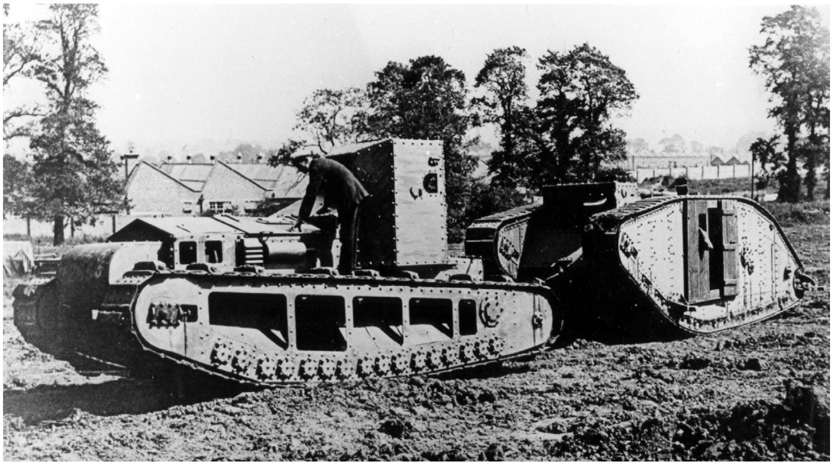
manifold would be situated on the outside in each case. Each engine had its own flywheel and cone clutch, behind which was its own gearbox, of the conventional type rather than the multi-chain version originally used on the B Type bus.

From the driver's point of view, the Whippet must have been something of a nightmare. In his seat, offset to the right of the turret, he was faced with a steering wheel, which also supported the ignition controls, two complete sets of gear controls and clutch pedals to go with them, and two handbrake levers.

There was no differential in the usual sense. Each engine and gearbox drove its own track through a 90-degree worm drive onto a divided half shaft, from the outer ends of which a sprocket and chain arrangement translated drive to the rear mounted track drive sprocket on each side. There would have been occasions, when one track started to slip badly, when it would have helped to have a device that linked the two half-shafts together. On the Tritton Chaser, according to the Oldbury programme, a simple dog-clutch system was employed to serve the purpose of a differential lock. In practice this may have placed too great a strain on the mechanism, because production Whippets are said to have had a limited slip clutch that became effective when the difference in power output from the two engines exceeded 12hp. This would have made driving on one engine extremely difficult, should the need ever arise, but not quite impossible.

There are certain things about the Tritton Chaser that we do not know. It seems reasonable to suppose that the radiator (or radiators) were located ahead of the engines, as they were in the production Whippets, but this remains unproven. It also seems likely that at this stage in its development the Whippet was started by a hand crank inserted at the front, via a hole in line with the port-side engine, although this certainly changed later. Another change was the location of the fuel tank, which initially Tritton placed at the back of his machine, down between the track frames.

There can be no doubt why Tritton elected to use this twin engine system; it enabled one man to drive the tank, compared with four men on what was then described as a 'standard' tank. More or less the same arrangement was planned for the proposed Flying Elephant 'super-tank', largely one imagines in pursuit of more power, although it may also have been part of the steering arrangements. One could speculate at length upon why Tritton does not appear to have consulted his colleague Walter Wilson on this, and indeed why Wilson does not appear to have been involved in the design of the Chaser at all. Tritton was a businessman as well as an engineer, so it makes sense that he would look for something simple and robust that could be



The Whippet prototype photographed at Dollis Hill towing a Mark IV. It is easily identified by its roller bearings at all wheel stations, but notice also the fuel tank, moved to the front but rounded on top. The Mark IV seems to be being towed as a deadweight load, perhaps to test the hauling powers of the lighter tank.

assembled from available components rather than anything that might be pushing the limits of technology. He may also have felt that, while helping his country and the war effort, it would do no harm to have a design of his own that might one day have some commercial application, should it prove successful.

The greatest difficulty we have is in pinpointing the date when the Tritton Chaser changed shape and was rebuilt without the turret. It seems safe to assume that in its original, turreted form the tank had a crew of two; the over-worked driver and the gunner/commander squeezed into his little turret. Perhaps it was simply that problems of communication between the two rendered the tank unfightable. All we can say for sure is that the tank was turreted when it took part in the Oldbury Trials, but was probably converted not long afterwards, as the tank was seen at a similar event with a rigid, angular superstructure instead of the rotating turret and, at a later time still, it was photographed with the fuel tank relocated to the front. This may well have been connected to the problem of centre of gravity. Concerns had already been expressed about the tendency of designers to add features and, as a consequence, weight to the rear of vehicles, which had a serious adverse effect upon the centre of gravity.

In this form, with certain detail differences, the tank was near enough identical to a production Whippet, although the prototype would have been constructed from unarmoured steel, which was easier to work. In order to achieve all-round fire, machine-gun mountings were now provided in all four faces of the superstructure. The superstructure, especially at the front, was extremely complicated and better illustrated than described. However, it is notable that the left side stands proud of the driver's position, totally obscuring his view in that direction, as indeed the turret did. There was now room for three, maybe even four in the cab, which relieved the commander from being the only gunner.

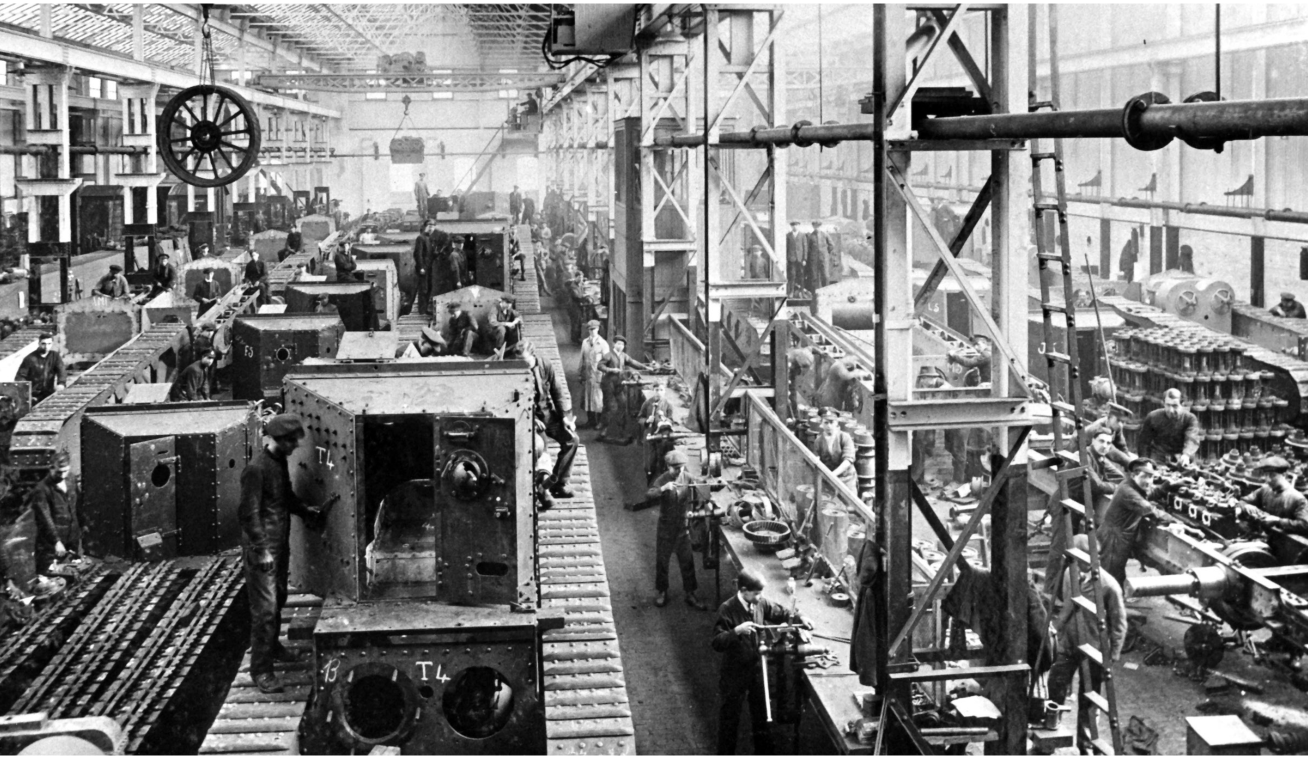
Since the Tritton Chaser, in its final form, is virtually indistinguishable from a production Whippet, it is useful to know that there is one certain way of telling them apart. In order to reduce rolling resistance and improve speed, Tritton fitted his Chaser with a full set of Skefco roller bearings on each side. Since there are 32 rollers (16 each side), the bearing caps are quite obvious. On production tanks, the number of rollers remained the same, but only the load-bearing six on each side were fitted with roller bearings and thus the distinctive bearing caps.

The ultimate fate of the Tritton Chaser is known. Towards the end of the war it was seen in the background of a photograph taken at the Mechanical Warfare Supply Department testing ground at Dollis Hill in north-west London, where it is sporting a pair of wheels on a frame at the rear similar to those seen on Mark I tanks in 1916. These had been fitted as a means of assisting the tank over wider trenches. A report issued after the war speaks of an experimental tail skid being fitted for the same purpose, but says that both attachments tended to take the weight off the tracks and reduce grip. The report goes on to say that the wheeled alternative was better in this respect, but still not good enough. When the war was over, the Tritton Chaser was included in a representative collection of tanks displayed at the original Imperial War Museum at the Crystal Palace in Upper Norwood, but was cut up for scrap when the museum transferred to a new site.

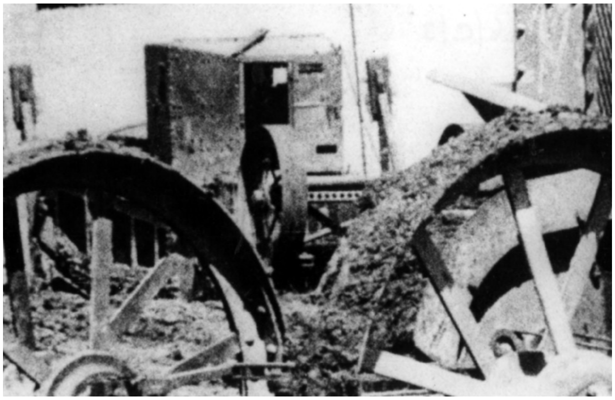
PRODUCTION OF THE WHIPPET

Foster & Co.'s book *The Tank: Its Birth and Development* claims that a total of 400 Whippets were ordered. However, only 200 were ever completed. These were the tanks built by William Foster & Co., which were numbered A200 to A399. It was normal practice not to begin each group of tanks from 1, since it immediately gave the enemy an indication of how many tanks of each type had been produced. However, it does raise the question of why the prefix A was used.

The same arrangement was employed with the gun carrier machines, which were numbered from GC100 onwards. However, since neither of these groups of numbers clashed with any other used for tanks, this form of categorization cannot have been for that reason. It was not used on subsequent models, the Medium B or Medium C. Perhaps it was instituted in order to make it clear that medium tanks were to be categorized in an alphabetical sequence instead of a numerical one, but that does not explain why it was dropped afterwards. All 200 of the Medium A Whippets were assembled at the Wellington Foundry in Lincoln, but photographs taken of the assembly lines show what appears to be a slightly haphazard arrangement. Tanks on



An interior view of Foster's works, the Wellington Foundry, showing Whippets under construction. The purpose of the wheel, hanging from the overhead crane, is not clear. Everything is on show here, from incomplete chassis to nearly finished tanks.



Not an easy shot, but the only one showing the Whippet prototype with a set of tail wheels. This prototype was seen at Dollis Hill and photographed across the tail of a gun carrier machine. Many of the staff at Dollis Hill appear to be Royal Naval personnel, perhaps members of 20 Squadron RNAS.

the extreme left are little more than chassis, while those on the centre line are more complete and those on the right are even less advanced. Even so, once they were completed, the tanks were taken out onto some rough ground adjacent to the plant and put through their paces.

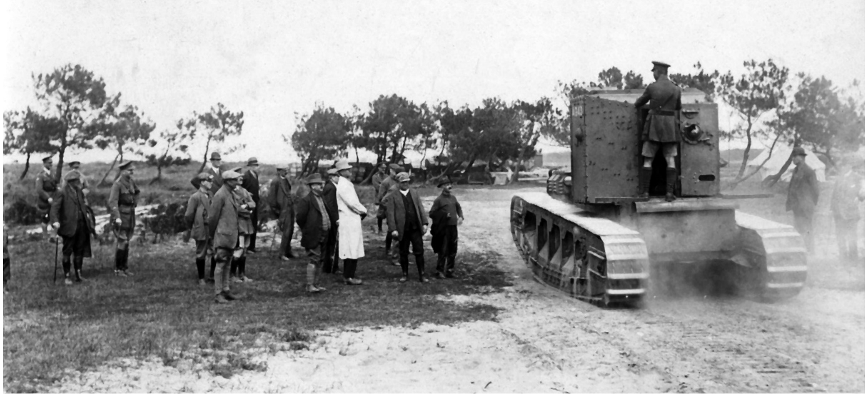
Although most of their significant features and crew duties are described elsewhere, there are others that warrant examination. For example, the location of the engines, under armoured covers at the front, was not accessible from inside the tank. Despite a large opening in the front of the cab that meant that they were visible, any maintenance carried out could be done only by the crew dismounting, going to the front, and lifting the armoured cover over the engine. Any work that had to be done required at least one man to work in the open, vulnerable to any fire that might have been flying about. On a heavy tank, by contrast, the location of the engine within the body of the tank meant that repair work could be carried out under the protection of the tank's armour.

It would be wrong to suppose that all 200 tanks were built at around the same time. Production was steady, but it was the summer of 1918 before the majority, 166 tanks, were actually completed, and a further three months before the rest appeared. Thus, although there were more than enough tanks, only two battalions were ever completed with the new tanks. There are rumours of a further 200 tanks being ordered in the summer of 1917, but it is unclear from whom. For a while, 400 Whippets were theoretically on order before being cancelled about four months later. It is not entirely clear why this order was revoked, since two heavy tank battalions were obliged to operate Mark IV tanks right through to the end of the war. The battalions could certainly have used the Whippets and it is known that some of the later formations, such as the 17th, were originally earmarked for completion as Whippet battalions.

None of this seems to have been understood or appreciated by General Headquarters (GHQ) in France. Almost immediately after the Oldbury demonstration, Sir Douglas Haig is reported to have asked for 200 of the new tanks to be delivered to France by the end of July 1917. Since the tank demonstrated at Oldbury was only a prototype and even then not in its final form, the size of this order would appear to be very optimistic to the point of being ridiculous. On the other hand, it does suggest that the staff at GHQ appreciated the potential of the new tank, even if they rather underestimated the degree of work involved in producing it.

DRIVING THE WHIPPET

Among the crew of a Whippet, the only man who had a seat was the driver. Behind him was a rack of ammunition boxes and ahead of him the controls. On the bulkhead in front of him was the visor through which he viewed the way ahead, and high up on the front wall was the Autovac fuel feed system. Directly in front of him was a steering wheel, which also incorporated the ignition control. The wheel was linked to both engine throttles so that the engines could be used to steer the tank. This was



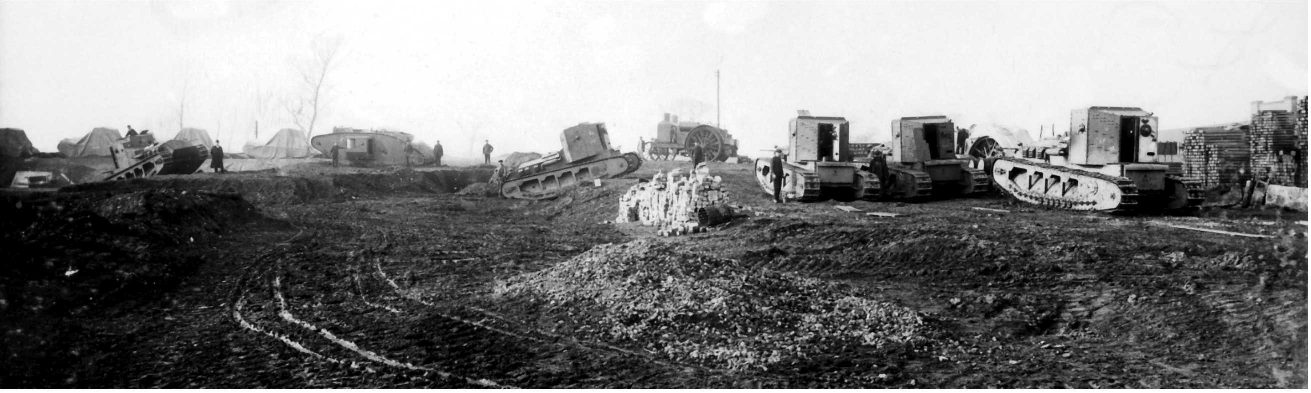
A new Whippet being demonstrated to the press, probably in France but well behind the lines. An officer is riding outside the cab at the back, perhaps in order to avoid being roasted alive.

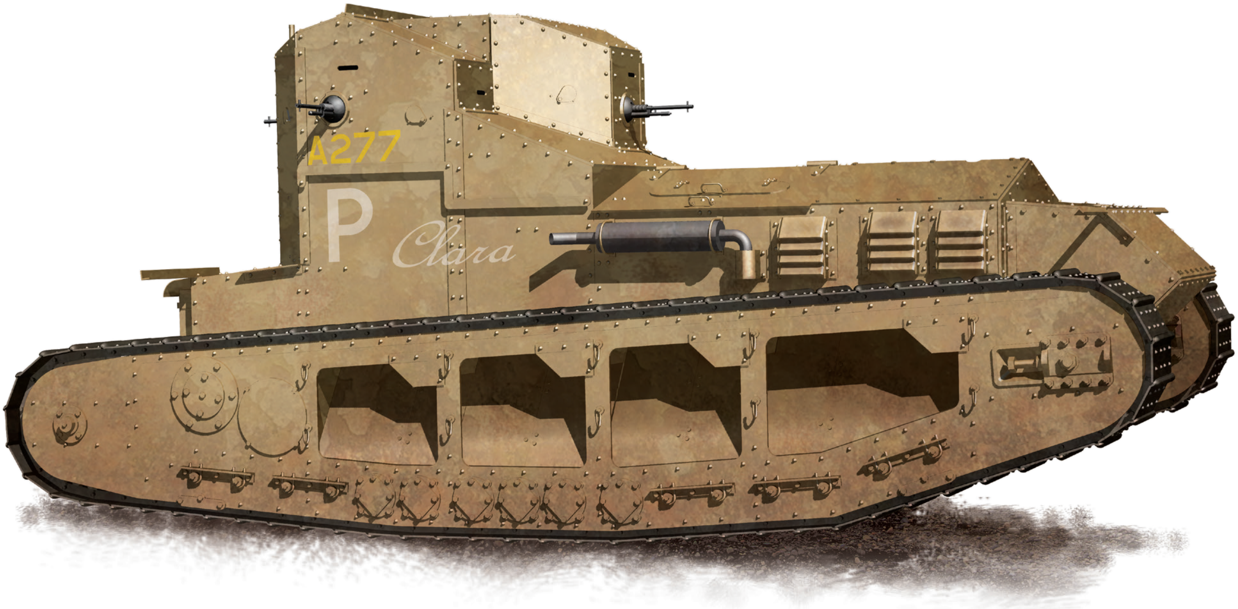
described in the driver's handbook as very 'light', which is taken to mean responsive, but it had its limits. This method of steering would not work when both engines were running at maximum power or when both had been throttled back to minimum revolutions, because the two throttles needed a bit of leeway to play with.

When driving at low power, below the level at which the engine governors came into effect, there was a tendency for the engines to react slightly differently to the throttle settings, causing the tank to 'hunt' or steer indiscriminately one way or the other. On normal ground this did not seem to matter very much, but in confined spaces, or for example when the tank was climbing onto a railway wagon, it was recommended that the driver engage the friction clutch, operated by a lever on the left side of his seat, which was effective so long as the difference in engine power between the two engines did not exceed 12hp.

First, however, it was necessary to start the engines using a crank handle. When it was safe to do so, the handle could be inserted from outside the tank at the back, but in action there was a secondary crank position on the inside, which required two men to turn it. The cramped conditions inside the cab made this difficult. It was also necessary for a crew member to raise a small lever at one side of the cab, which engaged the starting handle with the crankshaft of each engine while it was being started. The process was reversed when it came to starting the second engine. It was possible to start one engine if the other was already running by setting both gearboxes into reverse and driving backwards on the working engine until the other one fired up. However, this worked only on reasonably soft ground where the tracks could get a grip.

New Whippets being tested on waste land outside Foster's factory in Lincoln. There is also a Mark IV in the picture, although Whippets are clearly the focus of attention. The driving course seems to include different levels of ground in order to test each tank's cross-country ability.

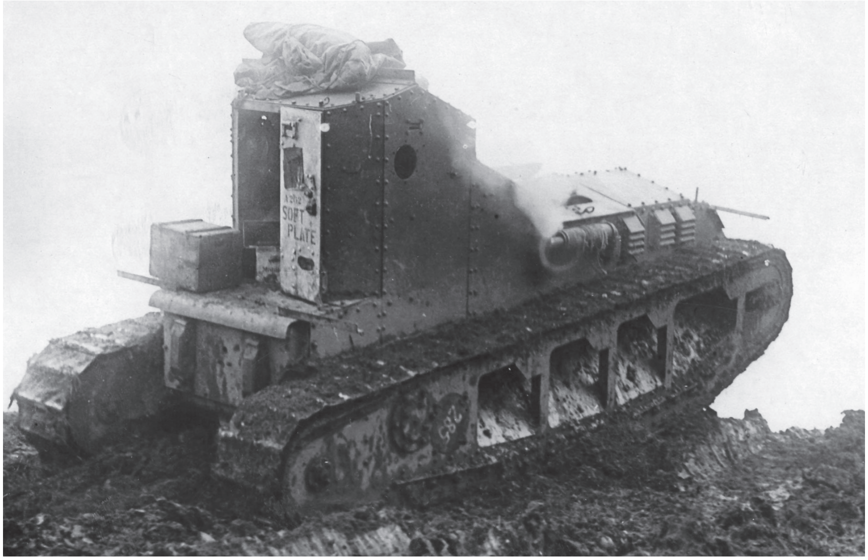




WHIPPET A277 OF X COMPANY, **3rd Battalion Tank Corps at Villers-Bretonneux, 24 April 1918**

This illustration is based on a painting of the tank commanded by Sergeant C. Parrott during the action near Cachy. The improvised X Company was commanded by Temporary Captain Tommy Price, and consisted of seven Whippet tanks. At 10.30am it was lying up in a wood, the Bois de Blangy, when Price was told by 58th Division that a message, dropped by an aircraft, reported two battalions of German infantry forming up for an attack. Price was ordered to go in and break up the attack. Price himself was on a horse, so he left the tanks in a hollow, with their engines running, while he went forward to investigate. Having seen that the open country was ideal for tanks he galloped back and ordered them to charge, due south, at full speed.

The tanks drove through the Germans with machine guns blazing and running over many troops, then turned and did the same thing again. Regarding the painting, Price took care to point out that the letter P on the tank stood for Parrott, not Price. Note the excellent view of the six central weight-bearing track rollers with their Skefco roller-bearing covers that distinguish a production Medium A from the prototype. (Art by Henry Morshead, © Osprey Publishing)



An early Whippet on test, with the rear door open. Notice that it is marked ‘Soft Plate’, suggesting that this tank has not undergone the full armouring process. This tank also lacks a lot of the details normally seen on service Whippets, and is also deficient in machine-gun mountings.

The driver had two clutch pedals and two complete gearboxes, with four forward speeds and one reverse in each. The gear change levers were located on either side of his seat, slightly forward and within easy reach of his right and left arms. The gears were changed sequentially during acceleration, not at the same time. However, since each gearbox was of the constant mesh type, it was possible to change gear while the tank was moving, something that was not possible in a heavy tank. This required the driver to double-declutch up and down each box.

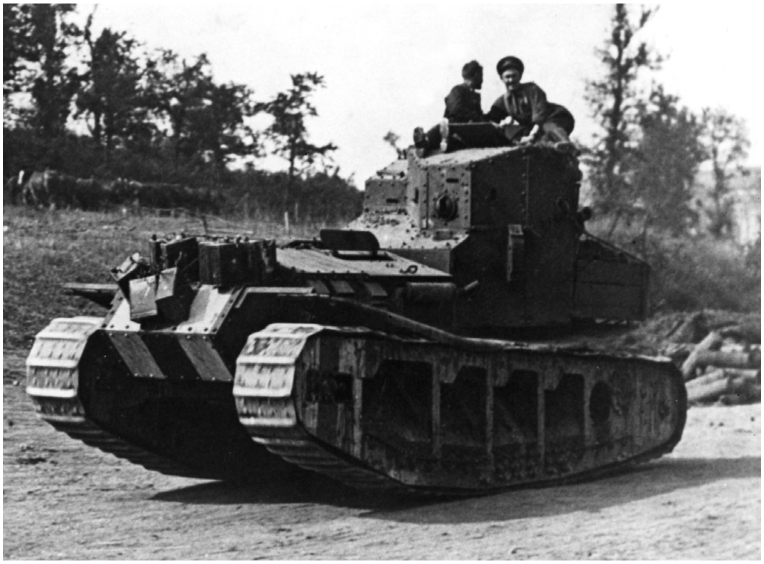
The clutch pedals, integral to the working of the gearboxes, were located in front of the driver's seat. These worked in the conventional way. The initial movement detached the drive from the engine and could be used to provide a free steering capability, although this only worked on very favourable ground. A more effective method of steering was to depress the clutch pedal even further in order to engage a brake, normally the clutch stop, which would also serve as a steering brake.

Even driving in a straight line was far from easy, since gears had to be changed successively up and down the box. For example, assuming that the driver had got the tank moving in first gear, the drill for shifting up to second was to depress one clutch pedal, move the gear lever on that side to neutral, raise and depress the clutch again, shift into second and then raise the clutch. This would be repeated on the second gearbox and so on up through the range as required. Naturally a skilled driver would slip through these evolutions in no time at all, and the system had the advantage, at least over the heavy tanks, that gears could be changed on the move, so that the tank could accelerate through the range from the minimum speed in first of 1¾mph to a maximum of 8mph in fourth. Speed, in the world of World War I tanks, is only ever a relative term.

In order to steer, the driver had various options. One was the variable throttle control as already described, which, by turning the wheel to the left, speeded up the right-hand engine and slowed down the left. This was transmitted through to the tracks, so that the tank would start to make a gentle turn to the left. This seems to have been the preferred method, since geared steering carried with it the risk of stalling one engine in the process. It has been said that the tank could spin around in its own length by having one gearbox in a forward gear and one in reverse, but this is not advised anywhere in contemporary documents and may well have been impractical. Recommended practice when making a sharp turn, or manoeuvring in a tight space, was to disengage drive to one side, either by declutching or knocking the gear into neutral, and powering the tank round by the other track. This would be enhanced by applying a brake to the undriven track, just as in a heavy tank. An extra brake drum with an external contracting band around it was attached to an extension of each worm shaft. Operated from two levers directly in front of the driver, these were used as parking brakes and were very powerful. The drive from each gearbox passed through a worm gear to a driving chain pinion shaft. From this gear, the drive passed by chain to pinions that meshed with the track drive sprockets at the rear on either side.

THE WHIPPET IN ACTION

Whippets first arrived in small numbers at the Western Front in December 1917. To begin with, only one or two were delivered to the 3rd, 6th and 9th battalions, but over the next couple of months they appeared in dribs and drabs, gradually replacing



A Whippet photographed near Demuin, on active service. Notice that two members of the crew, but not the driver, are travelling outside to avoid the heat, and see also the array of spare fuel cans tied on at the front. Its machine guns do not appear to be mounted, but note the canvas track guards on both sides.

the Mark IV tanks that the battalions had used at Cambrai and earlier. Even so, the units remained Mark IV battalions for the duration, although of course no actions were fought over this period.

Whippets were issued to C Company, 9th Battalion Tank Corps in April 1918, and although often sent forward fully equipped to fight they never in fact saw any combat action with the 9th. Two months later they were passed on to the 3rd Battalion and were replaced in the 9th by Mark V tanks, bringing C Company into line with the rest of the battalion. In fact for a while C Company, 9th Battalion operated with the two Whippet equipped companies of the 3rd Battalion, A and C companies (B Company was formed into Lewis gun teams at this time).

The 3rd Tank Brigade, which was in the process of converting to Whippets, was in reserve at Bray-sur-Somme, north-east of Amiens. Of its constituent battalions, only the 3rd was fit to fight, and a dozen tanks of C Company were dispatched to deal with the enemy, which was reported to be massing south-west of Cambrai. Arriving at the village of Colincamps around noon on 26 March 1918, they ran headlong into a couple of German battalions, which, seeing that tanks were upon them, broke and fled. The tanks pursued them eastwards almost to Serre and effectively broke up the momentum of the attack, killing and capturing a fair number of the attackers. This was regarded as an excellent early trial of the Whippets under combat conditions. Most of them had been running continuously for 16 hours before the action began, yet went straight into action and did not experience any mechanical failures at all. How the crews fared is not recorded. C Company, however, was commanded at this time by Captain T.R. ('Tommy') Price, who about a month later would be engaged in a very similar action.

At the same time, farther south, the Germans were sweeping across the country and the tank training area at Bray-sur-Somme was in their path. Five or six Whippets allocated for driver training were undergoing repairs, and since these could not be repaired in time they had to be wrecked by Tank Corps personnel and abandoned. These were therefore captured by the advancing Germans who, unable to repair them either, could only leave them where they stood, which is exactly how they were found when the area was recaptured some six months later.

On 14 April 1918 3rd Battalion was visited by Sir William Tritton, the designer of the Whippet. He was treated to a conference at which suggestions were put forward for improvements to the tank. These are not specified, but cannot have been very many, since the only action the Whippets had been involved in up to now had been very successful. It had not involved cavalry or trenches, so one imagines that the majority of comments were confined to the unpleasant conditions inside the tank. The designer was not in a position to do much about this at the time, but the

A very unusual arrangement: a Whippet being used to launch a French fishing boat at Bray Dunes. How much the driver can see of what he is doing is a bit of a puzzle. This was obviously not a normal duty for Whippets, and may be classified as help to the civilian population.

comments may have had some bearing on his later design for the Medium C tank, which was particularly good in this respect.

Five days later, on 19 April, the Whippet tanks held in brigade reserve were formed into a temporary X Company, command of which was handed to Tommy Price. On the 22nd, X Company moved up closer to the line in a position of readiness. The enemy were attacking heavily all along the line, aiming to isolate or capture Amiens in the aftermath of their great spring offensive, which had now been halted. It would be tempting to see the Whippets as a planned and deliberate ideal antidote to mass infantry attack, owing to their relatively greater speed and manoeuvrability, but the fact that they were in the area was the most likely reason why they were used. They simply happened to be in the right place at the right time.

On 24 April 1918, X Company was in action at Cachy. The company consisted of seven Whippet tanks: four from H Section, 3rd Battalion (the section commanded by Lieutenant L.B. Hore) and three from E Section, commanded by Lieutenant A. Elsbury, the whole company being under the command of Captain Price. Advancing into an area that appeared to be devoid of British defenders, the seven tanks ran into two battalions of enemy troops from the 77th Reserve Division advancing to attack. The tanks swept into action with their machine guns firing and effectively carved up both battalions, chasing them off the field and claiming about 400 dead. However, four Whippets were hit and put out of action. Two German A7V tanks were recognized, No. 525 *Siegfried* and later No. 504 *Schnuck*. *Siegfried* was first on the scene, commanded by 2nd Leutnant Bitter, but his gun was giving trouble. *Schnuck*, commanded by 2nd Leutnant Muller, came up later, but the Whippets were also under fire from 2nd Battery, 6th Guards Field Regiment, whose 7.7cm guns were more than capable of destroying a Whippet if they achieved a hit. It is not clear where the fire came from that knocked out the Whippets. A number of men from X Company were wounded in the actions, but only the crew of one tank, A256, were reported as missing. They were 2nd Lieutenant H. Dale and his crew Lance Corporal Lincoln and Gunner Herbert. Dale appears to have been killed, although the other two men were probably taken prisoner. In all, X Company seems to have suffered six men wounded and one killed for the loss of four tanks out of a total of 21 men and seven tanks engaged, which is not too bad when weighed against the decimation of two battalions. Even if the number of enemy killed was not as many as 400, there is no doubt that after the action neither battalion was fit to fight again.

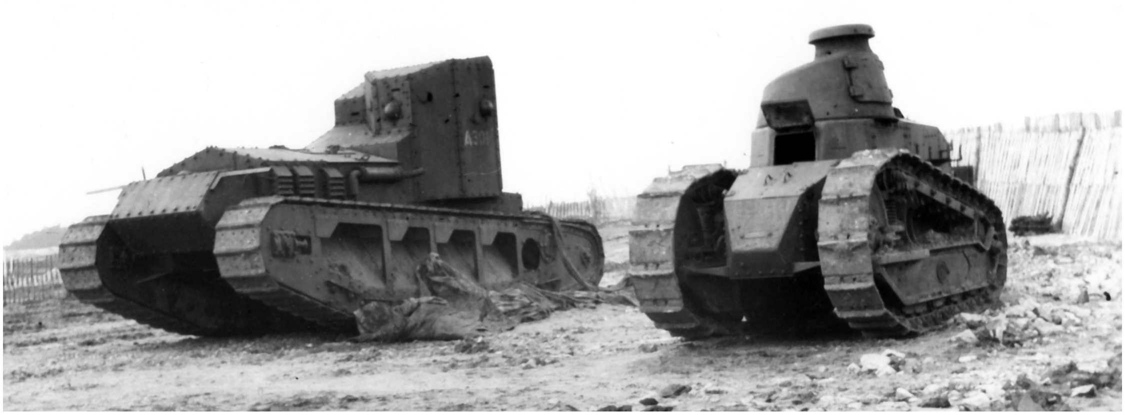
The following day, 25 April, Price was ordered to send his three remaining tanks to ascertain the situation. He discovered a shallow trench crowded with German infantry just west of a road in the area. His three tanks cruised along the road, firing into the trench with their machine guns and doing some execution. However, they also came under fire from a mass of enemy machine guns, and, although these machine guns were not firing armour-piercing rounds, they did manage to wound two crew members, Sergeant Hibbert and Gunner Stone, although both remained at their duty. All three tanks survived, although Price concluded his report by saying 'I consider that a low flying aeroplane would have been able to carry out this reconnaissance more effectively'.

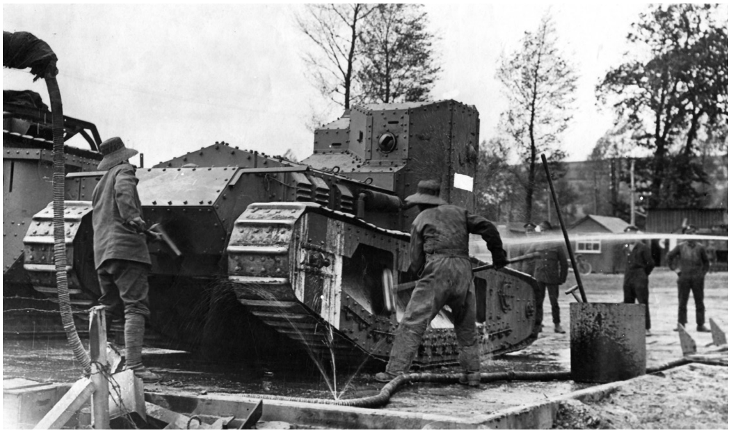
The following day Tommy Price himself was wounded. He had gone with 2nd Lieutenant Ritchie to examine one of the abandoned tanks on the Cachy battlefield when a machine gun opened up from inside the tank, wounding both officers as they approached. The infantry had informed them that the nearest Germans were 2,000 yards away. What was left of X Company was relieved by C Company, 9th Battalion on 28 April.

May 1918 seems to have been a relatively quiet month for the 3rd Battalion, although they were often held in readiness if a German attack began. All three companies had now come together again, and could muster 43 Whippet tanks between them. On 3 May they received a visit from Major Giffard le Q. Martel from Tank Corps headquarters, who came to observe the installation of explosive devices in tanks that were to be used for the purposes of demolition if the tank had to be abandoned or was in danger of being captured. Then on 25 May it was announced that in future C Company, 9th Battalion, attached to the 3rd Battalion, would be known as D Company, 3rd Battalion, but not for long.

The commanding officer of 3rd Battalion, Lieutenant Colonel S.H. Charrington, made the point firmly in one of his instructions that the tactical unit for light tanks was the Company, and that tanks should not be employed in smaller numbers than this. In a later report, he pointed out that as the British extended their trench system, and because in many places the trenches were impassable to light tanks, reconnaissance of routes became of the utmost importance. Towards the end of May, 3rd Battalion was involved in a major exercise with the 113th and 115th brigades. It is instructive to note that this involved cooperation with infantry alone and that cavalry was not mentioned at all.

An interesting comparison: a Medium A Whippet and Renault FT-17 light tank together at Bovington Camp. Although both were classified as light or medium tanks, they were surprisingly large.





Chinese workers hosing and cleaning down a Whippet at the Tank Corps Depot. It would have come in from the field liberally covered in mud. Whether the tank's number has been blotted out by the censor for security reasons is not clear, but it seems to be a pointless act.

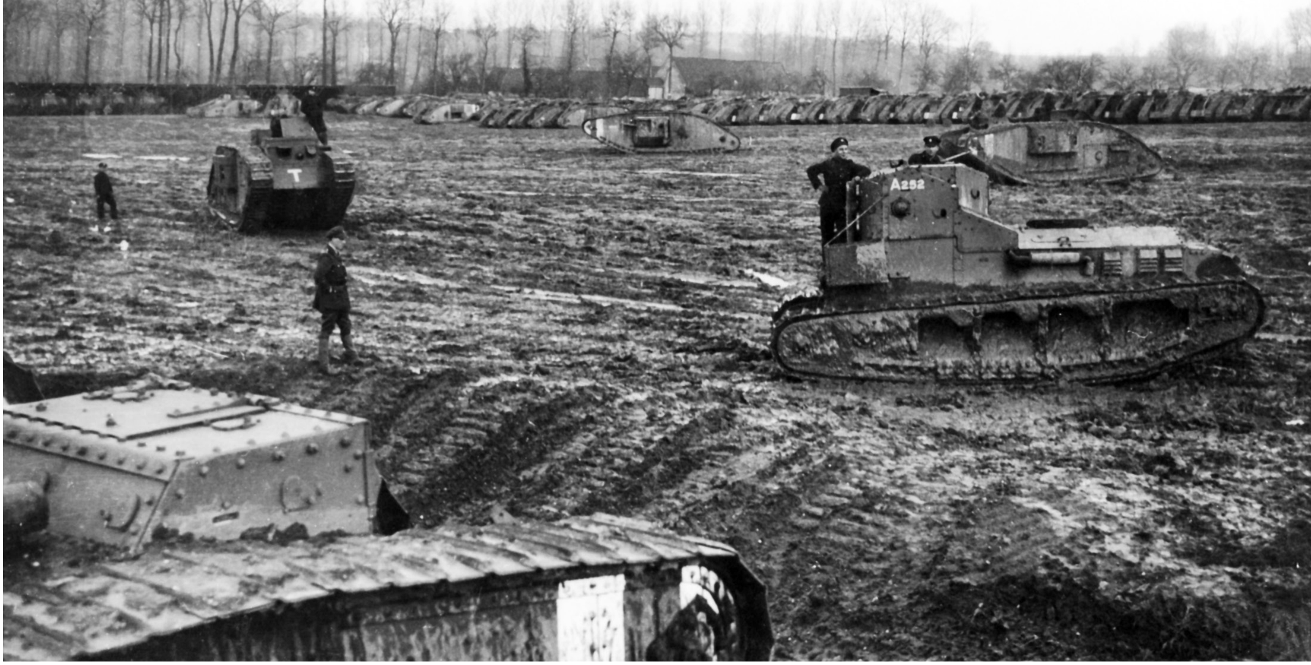
On 31 May, three Whippets from 3rd Battalion were involved in trench crossing trials near Puchvillers, the results of which were very instructive. Two trenches were selected. Trench A was 10ft wide at the top by up to 8ft deep, and Trench B was 10ft 3in wide at the top and 7ft 6in deep. They immediately discovered that the depth of the trench made no difference at all, but the width did. On Trench A the three tanks crossed easily in both directions, while Trench B proved impassable. Here, as a tank proceeded across and lost its grip on the near side, the back of the tank slid backwards into the trench until it came to rest, nearly vertical. The only way to get it out was to hitch another tank onto the front by rope and haul it until it was nearly level, at which point the engines could be restarted and the tank driven out with a bit of help from the towing tank. Attempts to make the crossing easier by digging ramps on the lips of the trenches made no difference. Captain May noted that when spuds were fitted to the tracks they barely had any effect at all. Who could have believed that a mere 3in would make so much difference?

In June, the battalion was increased by the addition of four Mark IV supply or baggage tanks, which were handed over to B Company on the 14th. On 20 June, it was announced that D Company, all of 26 days old, would no longer be known as such, but was to become the nucleus of the Battalion Driving School that was being established at the Bois Monsieur, near Talmas. Meanwhile it appears that 9th Battalion had already established a new C Company, equipped with Mark V tanks. It seems, at least from June onwards, that the old C Company, the Whippet Company, simply ceased to exist.

Nothing much else happened in June except that the entire battalion was stricken by influenza, but in July a series of experiments were carried out involving cooperation with the Royal Air Force. This involved 8 Squadron RAF (commanded by Trafford Leigh-Mallory), notably A Flight. Despite Tank Corps officers going up in aircraft and RAF officers travelling in tanks, it soon became clear that spotting an aircraft from a tank was difficult enough, never mind using it to obtain directions. However, 8 Squadron was established as a dedicated tank liaison squadron, so experiments continued.

Meanwhile, another battalion had appeared on the Whippet scene. 6th Battalion had started to receive a few Whippets in December 1917, and more in January 1918, but training had never really got under way because of the German spring offensive, preceded by complications due to inclement weather and a shortage of men, as replacements were still needed after the losses of the Cambrai battle. Except for the part the battalion played in countering the German offensive, which was largely a passive one, no more Whippet activity occurred until 15 June, when it finally handed in its old Mark IV tanks and six days later arrived by bus at Merlimont to commence Whippet training.

Conditions at Merlimont, on the Channel coast, were not good, with a lot of fine sand blowing about, while high midsummer temperatures meant that conditions inside the cab of a Whippet were worse than ever. Dealing with the sand demanded



A Whippet on the driving area, along with Mark V tanks at the Tank Corps Depot in France. It may be there for testing after being repaired, or just for crew familiarization. Most of the other tanks on the area are of the Mark V type. The bare trees suggest a winter scene, while the red and white stripes indicate late spring at the earliest.

a lot of ingenuity, but nothing could be done about the heat. Training was carried out on driving and on the Hotchkiss machine gun. Since the crew of a Whippet amounted to only two other ranks, in addition to the officer or NCO in command, it was regarded as essential that the men were all trained to drive and fight, although at the end of their training it was decided which men made the most promising drivers or machine gunners and they were given their roles accordingly. Trials at Merlimont were also carried out in tank/air cooperation, but the results were no better than for 3rd Battalion.

The battle of Amiens (8 August 1918) saw both Whippet battalions in action. The action began for both battalions with their moving into Amiens itself for an overnight stay on the eve of the battle. 3rd Battalion was directed to the Boulevard Pont Noyelles, where it parked up under the trees and the men were installed in adjacent billets for the night. 6th Battalion was directed to a boulevard that led out of the city in the direction of Villers-Bretonneux, and the men were billeted in a nearby school. There were strict warnings in place concerning the risks of enemy aerial reconnaissance. Nobody was to move or congregate near the tanks, no fires were to be lit outdoors, and men were to stay in their billets until it was time to go.

3rd Battalion started to move away from Amiens just before 9pm, followed by 6th Battalion, which started off about midnight. 3rd Battalion was to meet up with the 3rd Cavalry Brigade, which it was supposed to be supporting, while 6th Battalion was supporting the 9th Cavalry Brigade, but it is instructive to note that no combined training had been arranged beforehand and the extent to which either battalion could effectively assist the cavalry was worked out with senior cavalry officers only shortly before they moved off. One gets the impression that nobody had any great faith in the efficacy of this arrangement.

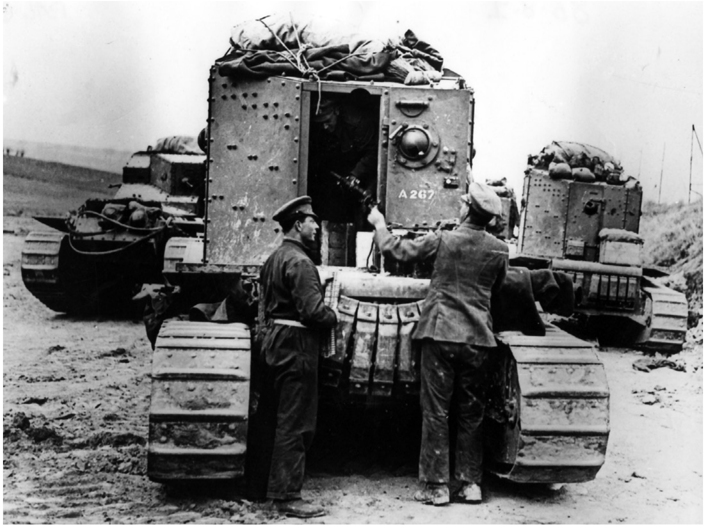
Rather than follow the experiences of these two battalions over the period of the Amiens battle, perhaps it would be more instructive to examine their general experiences with the cavalry, since, except on rare occasions, it was not repeated. The idea was that the first stage of the battle would be conducted by infantry divisions, supported by Mark V tanks, whose objective, known as the Red Line, was the second objective, about two miles from the start line. At this point the cavalry would take over, assisted by the Whippets, and race on to take the third objective, the Outer Amiens Defence Line.

6th Battalion summed up its experiences on the day by saying, in a marginal note in its history, 'Whippets not suitable for co-operation with Cavalry'. It went on to point out that either the cavalry wanted to advance at the gallop, leaving the Whippets behind, or the Whippets would move forward in the face of machine-gun fire, while the cavalry had to dismount and seek cover. The battalion also pointed out that when the Whippets came to take over the advance, they were obliged to operate over a great frontage and depth, so that even companies became scattered. Before long they were broken down into individual sections and the section became the unit, which was in direct opposition to Colonel Charrington's earlier directive. Because they were so scattered, and the distances were great, the only way senior officers such as company commanders could keep in touch was if they were mounted on horses, which accounted for the high casualty rate among them. Conversely, section commanders had to travel in one of their tanks in order to keep up, which made it difficult for them to maintain control.

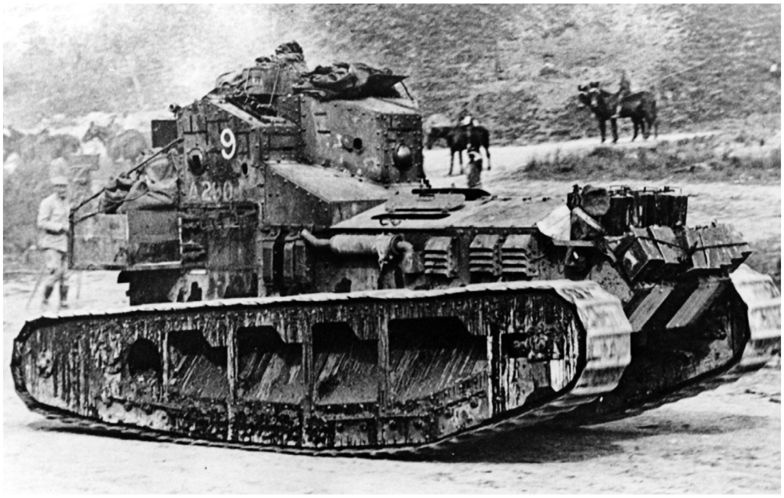
Cavalry also had an unfortunate habit of wandering off along routes such as sunken lanes, which often took them away from the direction of attack. It also seems that they were not aware of the limitations of the tanks. For instance, a composite section of seven tanks under Captain J.A. Renwick, after losing one tank to artillery fire, was directed over a segment of the old Somme trench system, where most of the trenches were overgrown and in a dilapidated state. All of the surviving six tanks became bogged down and three were subsequently knocked out by artillery fire. Meanwhile the other composite section, under Captain Chapman, found itself being directed along the Parvillers road, which, from a reconnaissance on foot, they found to be covered by two German field guns that would have been able to fire at point-blank range at any approaching tanks. There were also a number of occasions when tanks were sent to meet up with a cavalry detachment at a particular point only to find themselves alone.

Following one more successful action with the Queens Bays, two tanks finally broke away and went hunting on their own. One of these tanks, commanded by Lieutenant C.B. Arnold, became involved in clearing up an artillery battery in front of the 60th Australian Brigade, and then, having become separated from the other tank, went on a wild spree, shooting up enemy transport and troops at various locations before finally being knocked out and captured.

In the aftermath of the first three days of Amiens, the Whippet tanks seem to have been used for more general work, mostly in support of infantry. In the main, they used their mobility to attack nests of machine guns that were holding up the infantry. As they did so, there was a notable increase in tank casualties. Tanks were struck by artillery and



Whippet tanks being prepared for action near Albert on 28 March 1918. Notice how detachable track spuds have been slung across the back; this was not the usual place to find them, but was a lot safer in an emergency than clipped to the side. Other evidence suggests that they did not make much difference to the tank's performance.



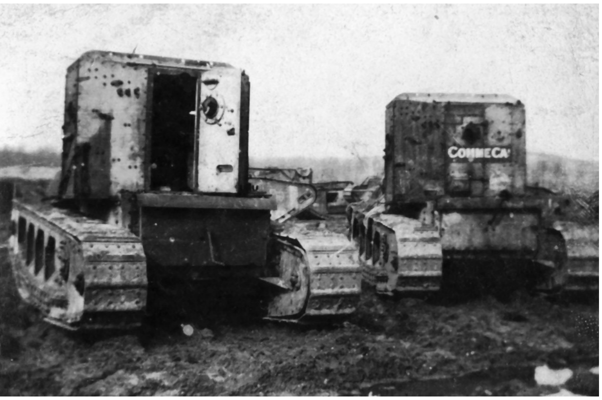
A Whippet that appears to be from Lieutenant Sewell's section, apparently working with the French. It also has a cluster of fuel cans roped onto the front and a small mountain of other stowage in the boxes on the back and on the cab roof. No weapons are mounted, but the black stripes painted on the cab are there to disguise the location of vision slits.

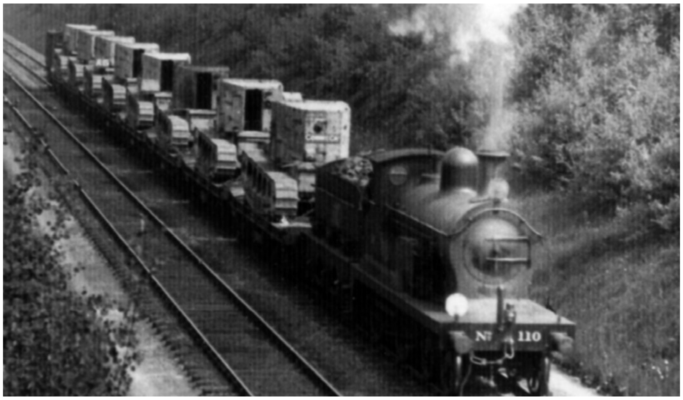
destroyed by fire, which often included the crew. Although they continued to use crews on alternating days, this still meant that the tanks were being employed on a daily basis, with precious little time to spare for maintenance. As a result, there were increasing instances of tanks breaking down, owing to simple things such as the fan drive breaking to more fundamental failures such as the complete collapse of engine components, particularly the big end. Heat continued to be a problem, and not only for the crew. Colonel Charrington, writing in the 3rd Battalion War Diary on 24 August 1918, pointed out that one hour's running with the door shut could render a tank weaponless except for the crew's revolvers. In the hot interior, machine guns would jam as rounds expanded or even exploded, and often the gun itself became too hot to handle. On one occasion the steering wheel became too hot to touch.

3rd Battalion latterly worked in conjunction with New Zealand, Australian and American forces, but supporting them in the infantry role, not as cavalry. Although it was noted that on certain occasions a heavy tank, such as a Mark V, would have been more suitable, Whippet commanders found that, if used cleverly and taking advantage of their manoeuvrability, they could outflank and destroy enemy machine-gun or artillery batteries. When used individually, the tanks were more vulnerable, and many were destroyed by direct hits, with the crew often lost as well.

There was a dramatic incident on 29 August, when Lieutenant Cecil Sewell rescued the crew of another tank in his section at the cost of his life, resulting in the posthumous award of the Victoria Cross. Actions continued, with every available spare moment given over to tank maintenance and with a dwindling number of serviceable tanks available. On 20 September, the entire 3rd Battalion could muster only 31 Whippets fit for action, and, of these, the tanks of B Company were allocated to work in conjunction with the Austin armoured cars of 17th (Armoured Car) Battalion, Tank Corps in an attack on the village of Bony. This failed, partly because on reaching the agreed meeting point the tanks found that the armoured cars had gone on ahead, but also because the intensity of enemy fire that they encountered, when they finally followed in the wake of the armoured cars, was so great that they had to withdraw, and in subsequent discussions it was agreed to call this interesting experiment off. The battalion's last attack in the war was against Serain on 8 October, when the commanding officer reported that in his view it was a task more suited to heavy tanks. The battalion was down to 11 tanks on this occasion. By the end of that month, the battalion was using Mark V tanks for training, and on 28 October it finally handed all its Whippets in to Central Workshops and started upon the new training programme.

There is an interesting account, told differently in the *Sixth Battalion History* and the *Tank Corps Book of Honour*, concerning Private Bertie Bussey, a Whippet driver





Above Left Two Whippets named *Comme Ci* and *Comme Ca* served with 3rd Battalion during the war. *Comme Ca* is shown here; the name of the other tank cannot be confirmed. Both tanks look semi-derelict and abandoned, although what appears to be an engine starting handle can be seen at the back of the tank on the left.

Above Photographed near Paddock Wood on the South-Eastern and Chatham Railway, a trainload of Whippets returning from the war. Four of them appear to have their back doors open. The train is said to be destined for Aldershot, but this may be no more than a guess. Bovington would seem more likely.

who, on 23 August 1918, after the officer and sergeant in his tank had both been wounded, alternately drove his tank and worked the machine guns – with the transmission locked – in action for about four hours until he was discovered and sent back to the rallying point. Private Bussey received the Distinguished Conduct Medal for his efforts.

6th Battalion had acquired its own Victoria Cross hero, also posthumously, in the shape of their commanding officer, acting Lieutenant-Colonel R.A. West, who had already earned a DSO (Distinguished Service Order) and MC (Military Cross). West, while riding forward to ascertain the best time to use his Whippets on 2 September 1918, came across the remains of an infantry battalion with most of its officers already dead and about to receive a strong counter-attack. West managed to inspire the men by riding his horse in front of them, but was killed in the process, although the attack was defeated. However, this had nothing to do with Whippet tanks. The following day, six Whippets were attached to A Squadron, Queen's Own Oxfordshire Hussars. This was the last occasion when they would work with cavalry, and it is interesting that when the advancing tanks passed through the villages of Hermies and Dermicourt, they found them free of Germans, yet, when the cavalry advanced, they encountered machine-gun fire coming from Dermicourt and lost three horses. This suggests that the enemy laid low when the tanks were nearby, but came to life again when a more suitable target approached.

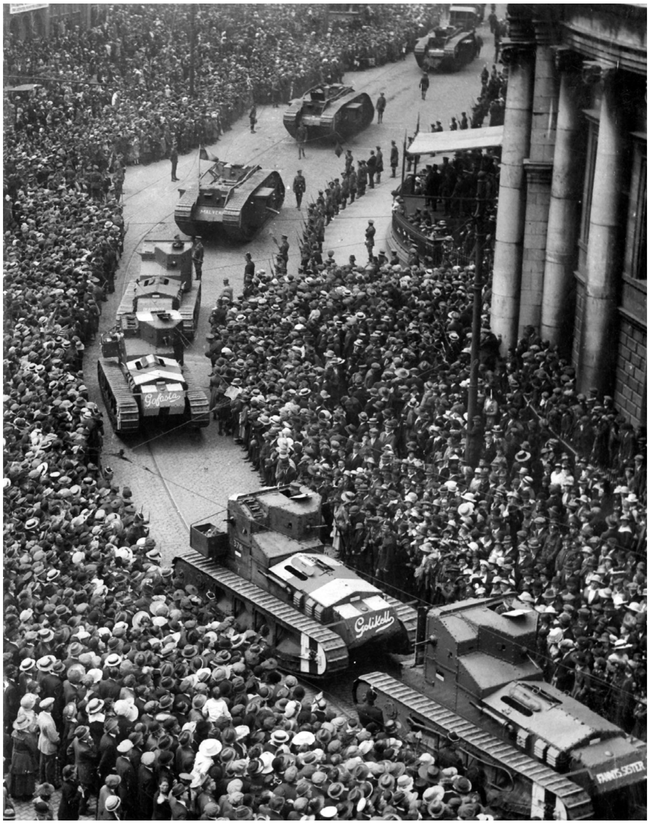
For the final few weeks of the war, 6th Battalion, like the 3rd, was gradually reduced to the point where composite companies had to be formed for specific operations. However, for various reasons, but largely due to luck, the 3rd Battalion does not appear to have suffered so many casualties. Its final action of the war began on 5 November in conjunction with the Scots and Grenadier Guards. It was only partially successful, but resulted in the Germans retreating overnight, and for the next few days what remained of the battalion was engaged in moving to a new location and working on its surviving tanks until the Armistice was announced on 11 November.

WHIPPETS ABROAD

With the ending of the war, some Whippet tanks emigrated. Some went to trouble spots where problems had arisen as a result of the war. Others were purchased by countries anxious to avail themselves of the new technology, while a few more were acquired by allies who thought they would make interesting memorials, particularly if their armies had seen action alongside British tanks and wanted a tangible reminder of the connection. At least two had been acquired by the Germans, which they proposed to use until they were repossessed.

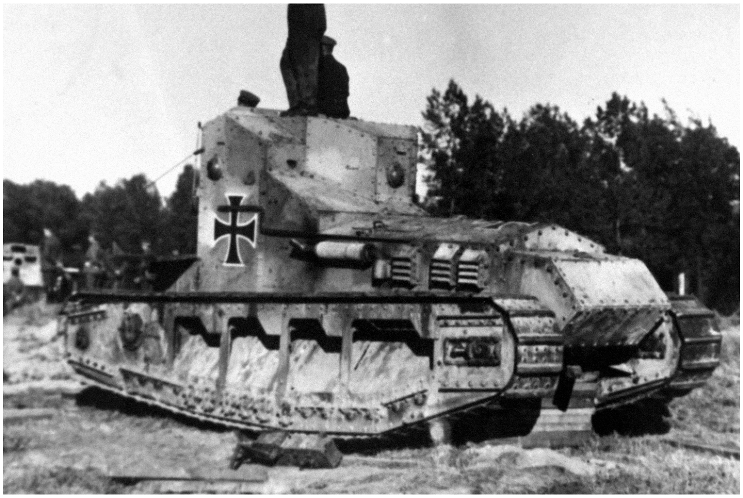
The Japanese obtained three or four Whippets, along with a Mark IV and some French Renaults, which they intended to evaluate and train with. They do not appear to have lasted very long. The Japanese Army fitted its own machine guns that were derived from the French Hotchkiss, and adapted the armoured panel in front of the driver so that it hinged upwards. This not only gave him a better view ahead, as far as that was possible, but it also helped to ventilate the fighting compartment, which was badly needed. The British Army took 16 Whippets to Ireland, where initially they formed B Company, 17th (Armoured Car) Battalion Tank Corps, which had been rushed across to Ireland from Germany at the end of the war. In due course they seem to have been sent far and wide throughout the country along with an interesting mixture of other tanks and armoured cars. For instance, two Whippets along with a Mark IV male tank and two Austin armoured cars formed Number 2 Detachment, Tank Corps based at Cork in 1919, while four took part in the victory parade through Dublin that summer. Six went with the British military mission of April 1919 to Russia in support of General Denikin, whose White Russians, bolstered by Allied help, were attempting to counter the Bolsheviks and their Red Revolution. Once it became obvious that this was going to be a more daunting task, a much larger detachment of tanks including more Whippets arrived in July 1919 and formed the South Russian Tank Detachment, which had the duty of training White Russian tank crews. This seems to have been a thankless task, because morale was low and the Revolutionary movement too strong. The men of the South Russian Tank Detachment were subsequently pulled out of the country, the tanks having been handed over to their White Russian crews. These did not last very long either, and the tanks were then captured and formed a substantial part of the rapidly expanding Red Army. They saw some action against the Poles in the West, the Japanese in the East, and dissident groups within Russia itself. There is some evidence that at least one Whippet had been modified to mount a 37mm gun from a Renault, much as had been done by the British, and it is said that in Red Army service they were known as Teiylors, on account of their Tylor engines. However, it seems that the survivors only lasted until about 1922.

Whippets leading the Victory Parade in Dublin in 1919, followed by three Mark V* tanks. The Whippets were named *Fanny Adams, Fanny's Sister, Golikell* and *Gofasta* (i.e. 'Go Like Hell' and 'Go Faster').



The Union of South Africa purchased one Whippet, which was named HMLS *Union*. It was intended as a memorial, although it seems to have been wheeled out during an industrial dispute in the hope that it might overawe the agitators. Unfortunately it broke down and had to be towed home somewhat ignominiously behind a steam lorry. Individual Whippet tanks were also sent to Canada and the United States.

In addition to the immovable wrecks captured by the Germans at Bray-sur-Somme, which had been too drastically damaged to be worth restoring, two more evidently fell into German hands in somewhat better order. Both were put back into working order by the Bayerischer Armee-Kraftwagen-Park 20 (BAKP20), which had established a tank repair facility in captured factory premises near Charleroi in occupied Belgium. One was delivered to Berlin, while BAKP20 retained the other for evaluation. A German officer commanding the captured tank force is reported to have said that in his opinion the Whippet was the only British tank worth copying, which may explain the design of the German tanks LKI and LKII. Both were completed too late to be of any material use during the war, and in any case suffered from the German commitment to engineering perfection, which delayed their completion until it was too late. The other Whippet, the one that went to Berlin, was photographed in Freikorps service during the street fighting against the Communist-inspired Spartacist movement in January 1919. Both tanks had to be handed over to British troops in the summer of 1919 when Germany finally surrendered.



A Whippet captured and put into working order by the Germans. It never saw operational use during the war, but was regarded as the best model for the Germans to copy. As far as is known, the Germans only ever acquired two Whippet tanks, at least in running condition.

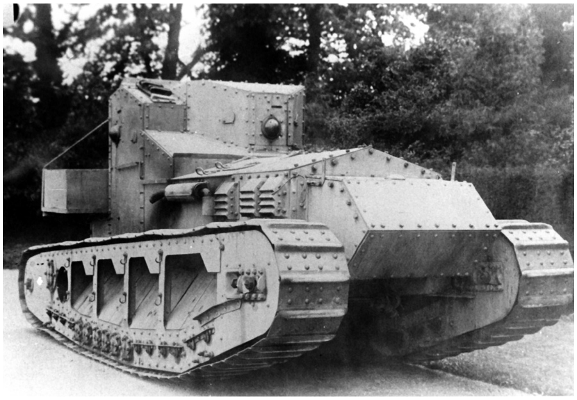
WHIPPET REPLACEMENTS

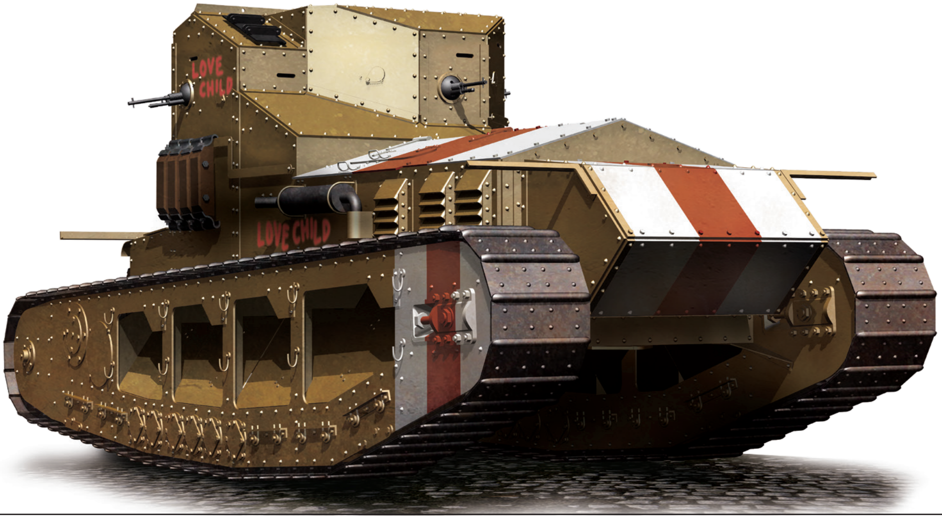
MEDIUM B

Nobody would argue that the Medium A Whippet needed replacing. The location of the crew compartment, the truly appalling conditions inflicted on the men, the complicated driving arrangements, poor driver visibility, and the extra time required to keep both engines in trim (thus doubling up maintenance time) were more than enough to condemn the tank in the eyes of those who had to use it.

Walter Wilson's tank design, created in June 1917, was bound to feature his transmission but, in an effort to reduce the size, he elected to use a shorter, four-cylinder version of the Ricardo engine rated at 100hp, many of which were manufactured by Browett, Lindley & Co. of Patricroft, Manchester. Wilson opted for a hull design reminiscent of a heavy tank with a rounded nose

A Whippet tank handed over to Commander Bayntum Hippisely RN for undisclosed experiments, photographed outside his house at Ston Easton near Bath. There is no obvious evidence of modification on the outside, so one assumes that whatever the commander was doing concerned the inside.





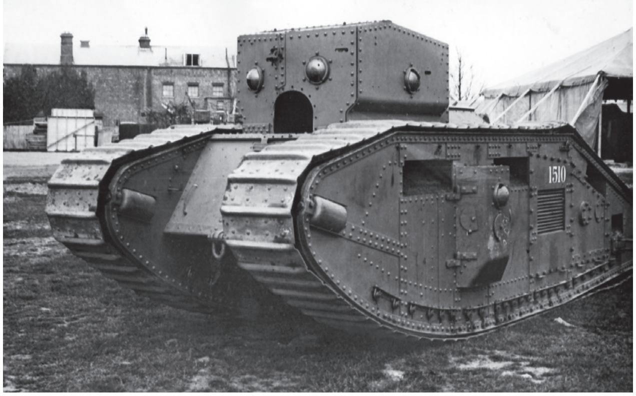
MEDIUM A WHIPPET *LOVE CHILD*, South Russian Tank Detachment, 1919

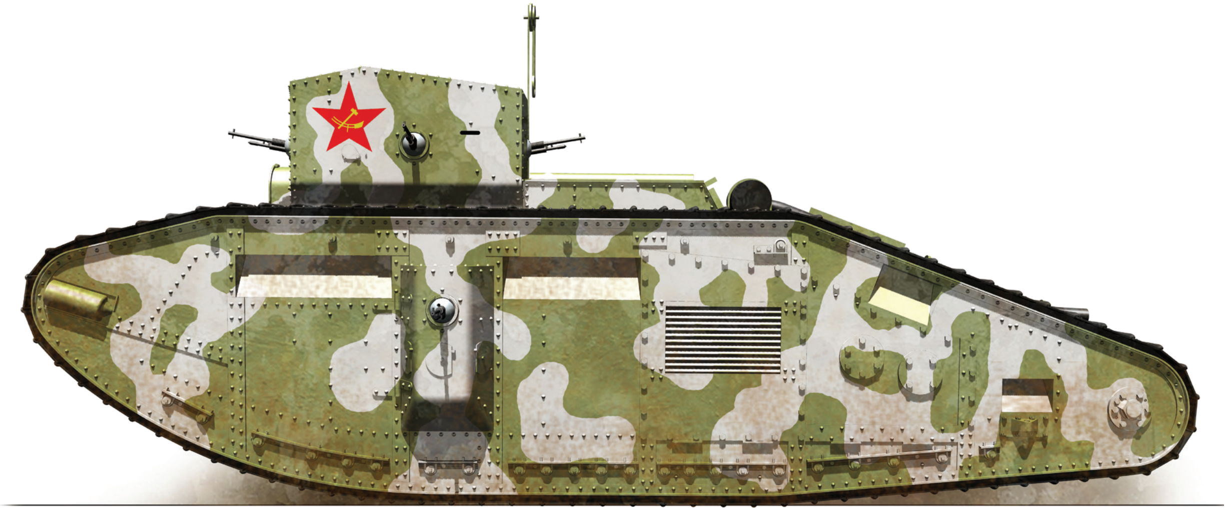
The South Russian Tank Detachment was formed in France after the Armistice. It arrived in Batum on the Black Sea coast on 13 April 1919 where it was joined by a second detachment equipped with six Mark V heavy tanks and six Medium A Whippets, all under the command of Major Neil McMicking DSO. They were there to support the White Russians under General Denikin, in the civil war against the Bolsheviks. They were later reinforced by about 50 more Mark V tanks and ten Whippets, which were handed over to the Russians.

This tank, nicknamed *Love Child* was photographed manned by a British crew. When White Russian resistance collapsed and the British left in June 1920 the tanks were taken over by the Bolsheviks; in Red Army service the Whippets were apparently known as Tyeilors after their Tylor 45hp engines. (Art by Henry Morshead, © Osprey Publishing)

and much higher entry point, which gave improved cross-country performance. He moved the crew compartment forward so that the driver was placed centrally, right at the front with the fighting compartment above and behind him. This included five ball mountings for Hotchkiss machine guns: two facing forwards, one to the rear, and one each side, along with the usual selection of pistol ports and vision slits. A double flap hatch was fitted in the cab roof for the commander to observe through, but no cupola was provided, although a trunnion could be fitted to support an anti-aircraft machine gun. Access doors stuck out on each side, looking like small sponsons. Each one of these was also provided with a ball mounting for a Hotchkiss machine gun, although this was subsequently removed. The tall central superstructure meant that it would be impossible to use a conventional unditching beam with this tank, so since some form of unditching apparatus was considered essential, the designers reverted to an earlier type, the Buddicom unditching spud, of which a pair was used, attached to the track on either side and flexible enough to slide by the superstructure as they went around. Since this system never seemed to work properly on earlier tanks, it is not clear how well it might have behaved on these later medium tanks, but since no photographs have yet been found showing them being used on a Medium B, this remains a bit of a puzzle.

An early example of a Medium B built by the Coventry Ordnance Works, still to be fitted with the driver's cab. Notice the machine-gun mountings in the superstructure and in the side door. These tanks could also mount an anti-aircraft machine gun if required.

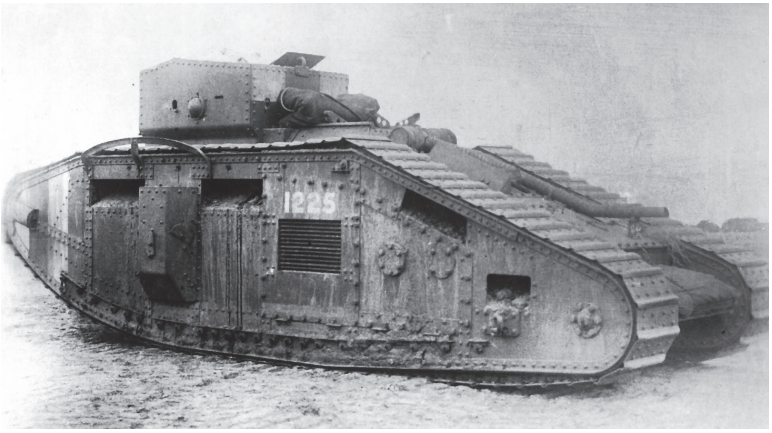




MEDIUM B

This tank had an interesting career. On entering Tank Corps service it was issued to the North Russian Tank Detachment, which sailed for Archangel in August 1919. It was then passed on to the Latvian Army, but subsequently fell into Bolshevik hands and entered service with the Red Army, finished in the rather colourful camouflage pattern depicted here.

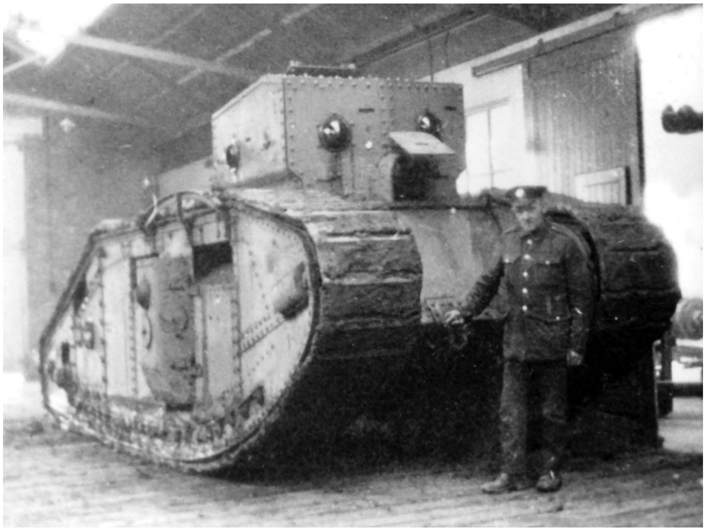
Medium B tanks were built by Metropolitan in Birmingham, the Coventry Ordnance Works and the North British Locomotive Company in Glasgow. Out of 700 ordered only 45 ever entered service, and none survive now. This tank cannot have lasted long in Soviet use, being a difficult tank for the crew to operate. It is shown fully equipped with air-cooled Hotchkiss machine guns. (Art by Henry Morshead, © Osprey Publishing)



A Medium B from the batch built by the Metropolitan Carriage, Wagon and Finance Company. Note that the machine-gun mounting on the side door has been blanked off. This rear view shows the long sloping engine deck, the location of the silencer and the exhaust pipe.

The engine was placed on the centre line of the hull directly in the rear of the fighting compartment, since it was important that it was set as far back as possible. Being a typical Ricardo design it was quite tall, which necessitated a slightly raised engine deck above the level of the top run of the tracks. It was water cooled with the radiator located in the left side, and petrol delivered to the engine by the Autovac system was carried in three petrol tanks low down at the very rear of the hull. The exhaust from the engine was led into a silencer mounted crosswise, and an outlet pipe carried the fumes down to the back of the tank. A device was fitted that injected sulphonic acid into the exhaust to create a smoke screen. Total fuel capacity was 85 gallons and fuel was consumed at a rate of ¾ miles per gallon, which gave the Medium B a range of about 64 miles.

Behind the engine was the typical combination of a four-speed and reverse gearbox, which was described as unreliable in practice, and a bevel box with pinions and gears linked to Wilson epicyclics at their outboard ends for steering. Chains then carried the motion back to the final drive sprockets, which meshed with the tracks.



A Medium B photographed with a Tank Corps soldier, although where and under what circumstances is unknown. However, this tank still has the machine-gun mountings in the side doors, so it must be an early example. The hatch in the cab roof is also open.

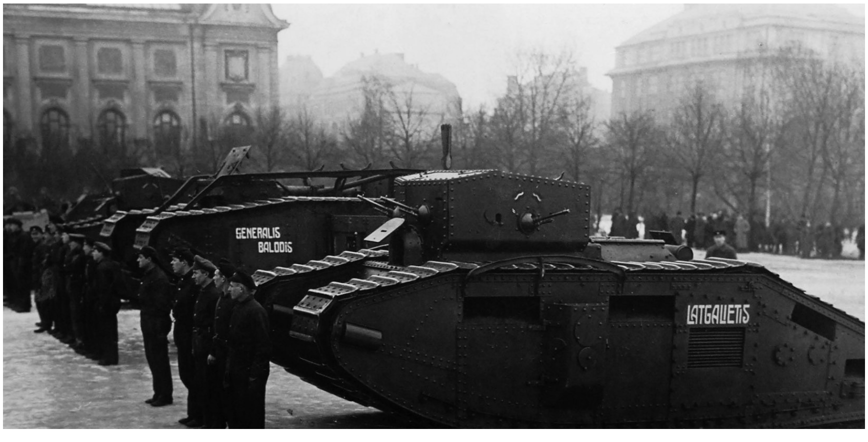
In top gear, the tank could manage just over 6mph. This was slower by 2mph than the Medium A, but the Medium B was four tons heavier at 18 tons and of course a lot easier to drive, particularly in terms of steering, which must have made a lot of difference.

Conditions for the crew inside were a lot better, since the engine was separated from the fighting compartment by a bulkhead with doors giving access to each side, but Wilson was severely criticized for the cramped conditions within the engine compartment, which meant that anyone trying to work in there with the engine running or just stopped ran the risk of being roasted alive. This could make a crucial difference if a tank were to break down on the battlefield.

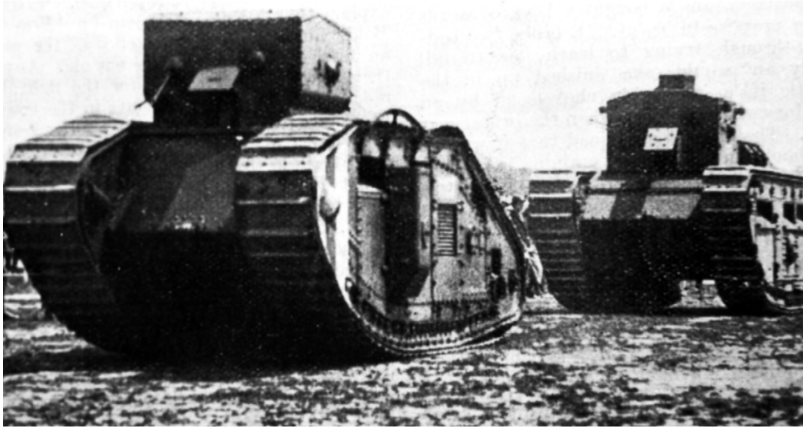
Orders were placed for some 700 machines with the Metropolitan Carriage, Wagon and Finance Company in Birmingham through their subsidiary the Patent Shaft and Axletree Company of Wednesbury (although this order was soon cancelled) and with the North British Locomotive Company and the Coventry Ordnance Works in Glasgow. The prototype, which was completed by September 1918, was built in Birmingham, presumably where Wilson could keep an eye on it. However, the first production tank appeared from the Coventry Ordnance Works.

All told, some 102 Medium B tanks were completed, and the number sequences seen in photographs suggest that some of them were built by all three contractors. Of these, 45 were taken into service and the remainder scrapped. It is not clear how many were completed by each contractor.

A version of the Medium B was proposed to mount a 2-pdr gun. However, this must have been an entirely new weapon and not the automatic Vickers pom-pom. References claim that design work on the 2-pdr held up production of the 6-pdr gun fitted in male heavy tanks, but where this new weapon might have been mounted in a male Medium B is not recorded. In any case the project was abandoned in March 1918.



One Medium B, originally part of the British North Russian Tank Detachment, ended up in Latvia and is seen on parade in Riga with some Mark V tanks from the same source. Ultimately it must have fallen into Soviet hands, and here is still apparently in excellent condition.



This is the only known photograph of a Medium B and Medium C tank together. It was taken at Bovington during a parade for the General Officer Commanding Southern Command in May 1919. The rail on the side of the Medium B was intended to prevent the machine gun from firing into the hull.

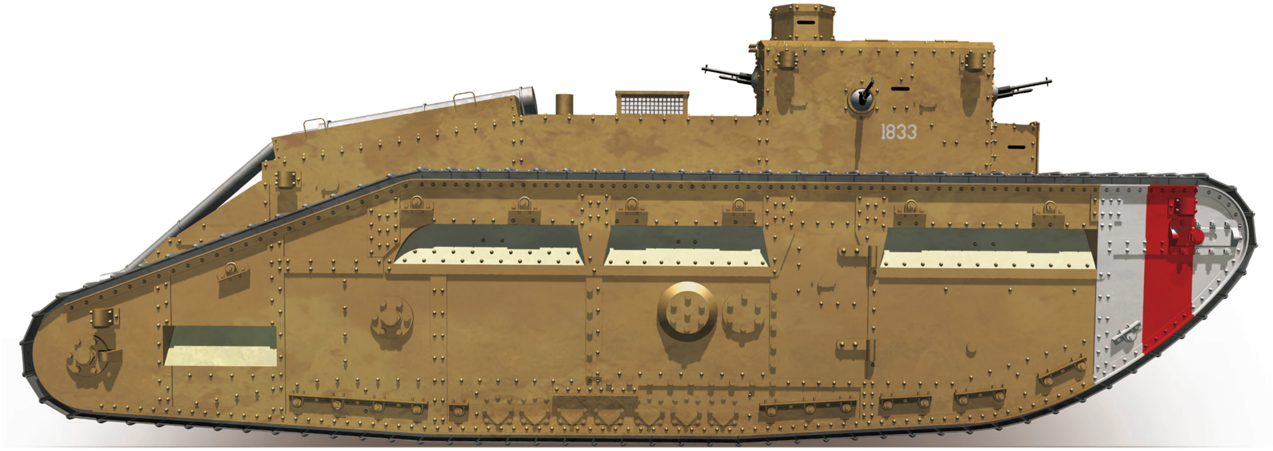
The post-war career of this all but forgotten tank is not well recorded. An unspecified number were shipped to Dublin to join C Company, 17th Battalion Tank Corps, which was based there, but little is known about them and no photographs have come to light, suggesting that there were not many of them and they were rarely used. Three Medium Bs were shipped out to Archangel to join the North British Tank Detachment, which was stationed there to protect the port and vast stocks of British supplies from falling into the hands of the Bolsheviks. Of these three, one tank and a Mark V heavy model were passed on to White Russian forces, who reputedly used them quite effectively. However, when the Bolsheviks closed in they refused to surrender them and reportedly sank the tanks in the river Dvina; the other two were handed over to the Latvian Army when the British pulled out in October 1919, and one of these was still in Latvian service in 1926. However, photographic evidence suggests that one Medium B fell into Bolshevik hands and was put back into working order in Moscow; its ultimate fate is not known.

In Britain, at least one Medium B was issued to the Royal Engineers Experimental Bridging Establishment at Christchurch, where it was used to test new bridges. This tank, or a similar one, was seen on 23 January 1941 at Christchurch, stripped of most of its internal fittings as part of the test load for a Mark III Inglis bridge, but this was wartime and it did not survive. A few Medium B tanks must have remained at locations such as Bovington, but none ever seem to have entered battalion service apart from those in Ireland. In due course they were presumably all scrapped except for one, earmarked for the original Tank Museum collection, which ultimately also went for scrap. Perhaps this is a comment on its perceived significance.

MEDIUM C: THE HORNET

If one ignores Foster's propaganda and accepts official information, then design of the Medium C commenced in March 1918, about nine months after the Medium B and only a month after the first production example of Wilson's tank had been delivered. This raises a number of questions. Assuming this was before faults with the Medium B became obvious, why did the designers bother with a new model? And why in any case did not Tritton and Wilson cooperate on the design following the success of their earlier partnership? There is no evidence to suggest that they had fallen out. On the other hand, it was clear that Tritton's earlier design, the Medium A, was not entirely satisfactory, and Wilson as the inventor of the epicyclic steering system probably thought that he could do better. Maybe the authorities felt they should have two strings to their bow, namely the inventive genius of Wilson and Tritton the experienced engineer with excellent manufacturing facilities at his back.

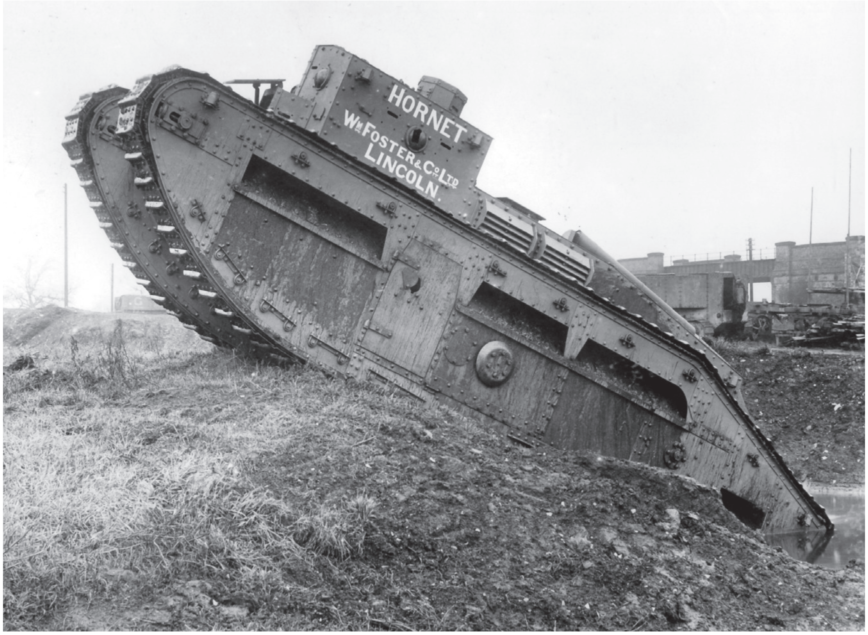
We will probably never know for sure. Both tanks were similar in design, although the Medium C was the larger; indeed, it was longer and taller by a few inches than



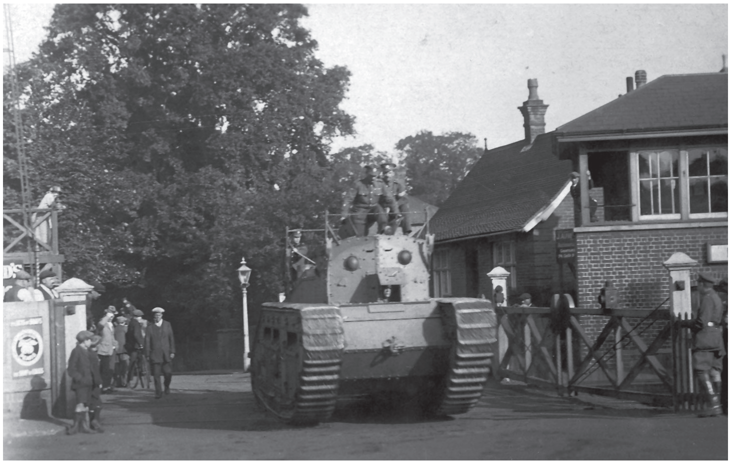
MEDIUM C 'The Hornet'

The Medium C was always reckoned to be the best British tank of World War I although it had never been in action nor served overseas at all. It was, however, the culmination of all that was best in tank design by World War I standards. Out of 50 built, 36 were taken into Tank Corps service after the war. However, at one point when it looked as if the war would continue into 1919, 600 Medium Cs were on order, all from William Foster & Co., of Lincoln. Of the tanks built, 24 were issued to 2nd Battalion, Tank Corps, then based at Farnborough, but were all replaced by more modern tanks by about 1923.

Designed by Sir William Tritton and nicknamed 'the Hornet', the prototype was completed in August 1918, but production tanks were not expected to be ready for delivery before January 1919. They were big tanks, similar in size to a heavy tank, but only required a crew of four, two of whom had to manage up to five machine guns between them. However, at 20 tons they were a good deal lighter than a heavy tank (which weighed around 28 tons) and they had a respectable top speed of nearly 8mph. The highlight of their military career seems to have been in July 1919 when four Medium C tanks were selected to represent the Tank Corps in the London Victory Parade. (Art by Henry Morshead, © Osprey Publishing)



Photographed on the waste ground adjacent to Foster's factory in Lincoln, this is the Medium C Hornet prototype being put through its paces. Notice in particular the commander's cupola on top of the superstructure. This gave the tank commander an all-round view of the battlefield.



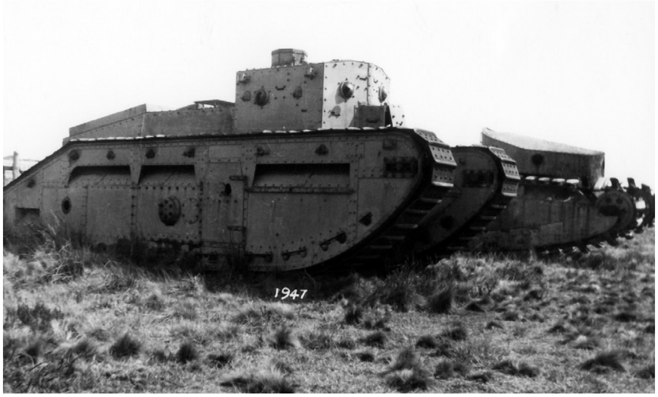
A Medium C belonging to 2nd Battalion, Tank Corps, seen going over the level crossing at Farnham in Surrey. This seems to have been quite a favourite route for the tanks, which were based at Aldershot. 2nd Battalion retained the Medium C right up to the time that it was issued with the new medium tanks early in 1924.

the old heavy tank of 1916, but not as wide, since it did not carry sponsons. One feature that Tritton made much of was the fact that the crew compartment was a much healthier place; in fact, it was not much warmer than the ambient temperature outside. This may also have been true of the Medium B, but since Tritton made more of it, the suggestion is that he was well aware of the problems with the Medium A and wanted to advertise the fact that he had overcome them.

The crew of the Medium C came to four: a commander, driver, and two gunners, as in the Medium B. However, the gunners would have been kept busy in action. There were two Hotchkiss machine-gun mountings in the front of the superstructure, above the driver's head, one in each side of the superstructure and one more at the back, along with one that could be fitted to a trunnion mounting in the roof hatch for anti-aircraft use when required. There was also a pistol port at the very back of the tank, alongside a small escape door. The gunner would have had to make his way down a narrow corridor at the side of the engine to reach it and was then cut off entirely from the rest of the crew. The commander on the other hand was provided with a rotating cupola, or lookout turret as it was called then, high up on the roof of the superstructure that gave him an uninterrupted view all around the tank. The only drawback was that this had to be removed for rail travel, since it exceeded the railway loading gauge. Once again the central superstructure of the Medium C meant that a conventional unditching beam could not be used, and reports suggest that individual torpedo spuds were provided instead; however, the same problem would have applied as indicated for the Medium B, and there is no hard evidence to show whether they were used or not.

As with the Medium B, it was proposed to arm some if not all of the tanks with a new 2-pdr weapon, although whether this would have made it a male tank is not entirely clear (this term was never used with the medium tanks, so it may have been considered as a means of enhancing the firepower of all tanks). In the event, as we have seen, production of the 2-pdr was halted because it compromised the 6-pdr programme.

As it was over 3ft longer than the Medium B, it proved possible to equip the Medium C with the full six-cylinder Ricardo engine. However, now that wartime restrictions on the use of alloys were coming to an end, it was possible to use more aluminium in the construction of the engine, so that it was appreciably lighter than the version adopted for the Mark V, although it still delivered the full 150hp. The engine was installed facing backwards so that it drove forwards through the clutch to a Wrigley four-speed gearbox, via a bevel box to cross shafts that engaged with epicyclic steering gears in the frames and then through two successive loops of chain and intermediate sprockets to the final drive track sprockets at the back. The four-speed gearbox was identified as the component most likely to give trouble. Above the gearbox was the radiator, set longitudinally and cooled by a pair of opposed fans on a drive shaft.



Above This Medium C tank was displayed in the original open-air Tank Museum at Bovington Camp. Sitting alongside it is the Medium D* prototype. If the figure on the print is the date the photograph was taken, then they are two of the tanks not scheduled to be included in the new museum, and were unfortunately scrapped.

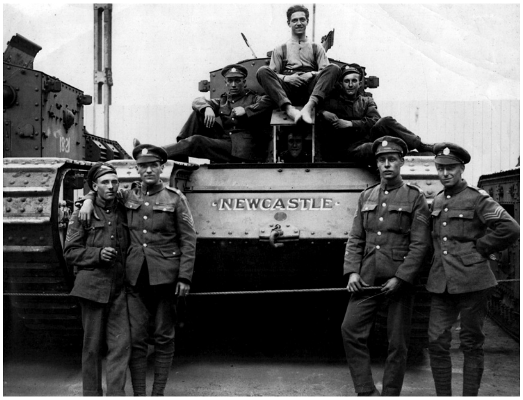
Above Right His Majesty King George V and Queen Mary, with a bevy of senior officers, are introduced to a Medium C tank belonging to 2nd Battalion, Tank Corps, at Aldershot. The tank was later put through its paces for the benefit of the royal visitors, climbing over an earth mound and knocking down a brick wall.

One very typical Tritton touch first seen on the Whippet was a central cluster of seven track rollers on each side covering the main weight-bearing point on the frames that were fitted with roller bearings and contributed to the Medium C tank's excellent top speed for its day of nearly 8mph. Even so, the new Medium C was not quite so well armoured as Wilson's design, since maximum armour thickness was just 12mm covering vital parts compared with 14mm on the Medium B.

However, there were proposals to create what was in effect a male version of the Medium C, referred to by the surprisingly modern term of 'tank destroyer'. No example was ever built that we know of, although drawings survive in the Illustrated Parts List so we have a pretty good idea of what it might have looked like. The superstructure was raised above the crew compartment, and a complete mounting for a 6-pdr gun provided in such a way that the weapon extended forwards above the driver's head. The original scheme seems to have been to use the 23-calibre weapon as fitted to Marks IV and V tanks, but upon consideration it was felt that the muzzle blast from this could affect the driver, so the plan was altered in favour of the old 40-calibre gun as fitted to male versions of the Mark I tank of 1916, which moved the muzzle a further 38in away from the driver's position and presumably spared him from the effects of the blast. Since the 40-calibre gun had a marginally better performance than the later version in terms of range and muzzle velocity, this might have improved its performance against other tanks, but since it was never built or used in action this is only academic speculation. The drawings of the superstructure of the 6-pdr also show extensions bulging out over the tracks at each side, and it seems as if the side mountings for the Hotchkiss machine guns were moved here and set facing forwards.

A Medium C on a road run just outside Bovington Camp. It has halted for this rather atmospheric photograph and one of the crew is posing on the side. A number of Medium C tanks were retained at Bovington, in addition to those serving with 2nd Battalion at Aldershot, and they were sent on some extensive road runs.

Four Medium C tanks represented the Tank Corps at the London Victory Parade of July 1919. None ever went abroad, but a few were used at home in support of the civil powers at times of industrial unrest, such as the Liverpool police strike or the potential riots in Glasgow. Experience soon showed that armoured cars were far more suitable for this work, being more mobile and less threatening, but such was the reputation of tanks at this time they were chosen instead.



Medium C tanks took part in what we now know as the Royal Tournament in 1919. Here they are seen with their crews, relaxing between performances. They gave their display in conjunction with some Mark V** heavy tanks, including at least one mechanical bridgelayer.

Twenty-four Medium C tanks formed A and B Companies of 2nd Battalion Tank Corps (12 tanks per company), which moved from Bovington to Farnborough in 1921 and became a common sight on the roads around that part of Surrey. They took part in a number of Southern Command exercises until replaced by more modern medium tanks from about 1923.

No Medium C survived to be preserved, but some six tanks were still around in 1930. They were taken out of store and sent to the Mechanical Warfare Experimental Establishment (MWEE) at Farnborough for potential use as tank recovery vehicles. Nothing survives to show what modifications might have been involved. In any case the project was abandoned, and with that the Medium C disappears from history.

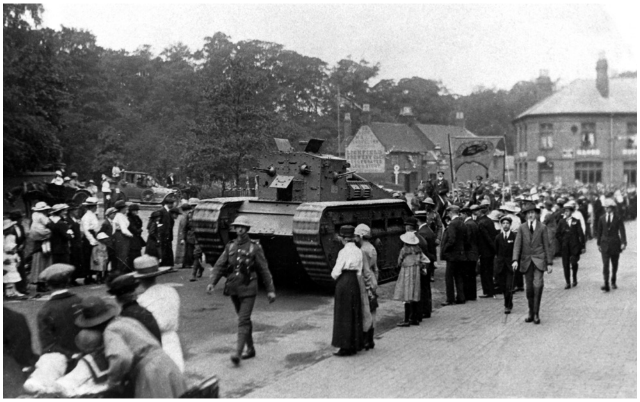
MEDIUM D

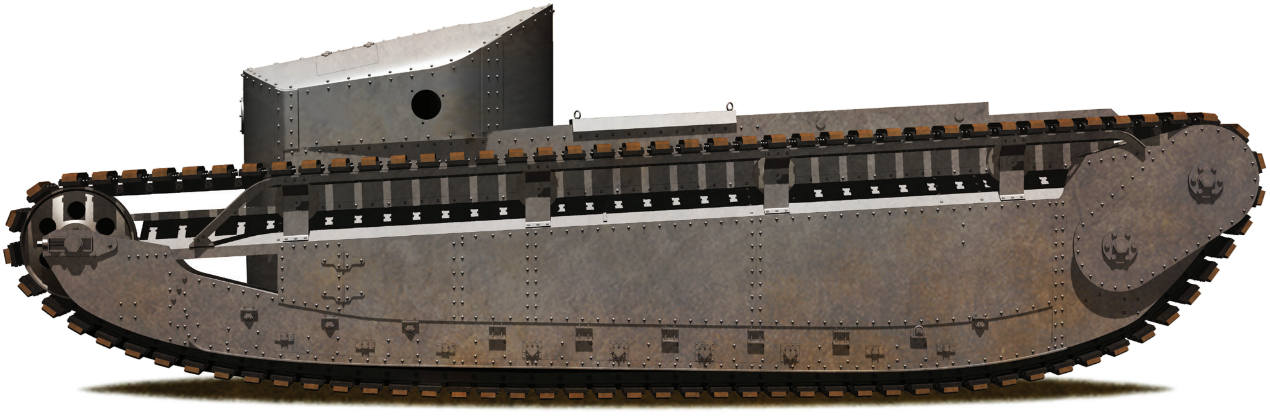
Major Philip Johnson, who commanded No. 3 Advanced Workshops in France, was a gifted and inventive engineer who before the war had worked for Fowlers of Leeds in their Bombay office. Johnson's inventive genius was such that No. 3 Advanced Workshops was dedicated entirely to experimental work that they continued to do under Johnson's instructions when he was transferred to Tank Corps headquarters in France. Johnson was dedicated to making tanks go faster, and he realized that, in order to do this, tanks required springs. His first attempt to do this involved a Mark IV, although no details of this and no photograph have yet been found. Johnson then conducted a more radical experiment on a Medium A, which did achieve impressive results.

He did, however, also appreciate that providing springs for every wheel station increased the weight, and in an effort to overcome this developed a novel arrangement whereby a system of flexible steel wire rope was employed as the main suspension system, running over and under pulleys and connected to a spring at the end. Thus as each wheel rose over an obstacle it forced up the cable, which pulled on the spring.

Bottom A Medium C tank on parade at Rugeley in Staffordshire at the end of the war. What it was doing there and where it had come from is unknown. Notice the open, double-flap roof hatch located ahead of the commander's cupola, and the partly open driver's visor.

Below Left The Victory Parade passing over Westminster Bridge on 19 July 1919. This picture shows the Tank Corps detachment of four Medium C tanks, preceded by a marching squad of officers and men representing the wartime Tank Corps. Two Tank Corps officers, Brigadier Hugh Elles and Colonel J.F.C. Fuller, led the procession on horseback.



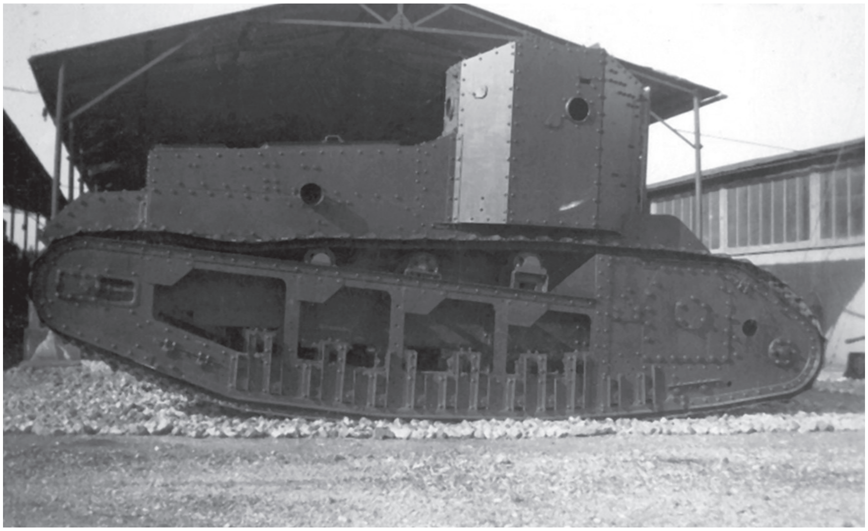


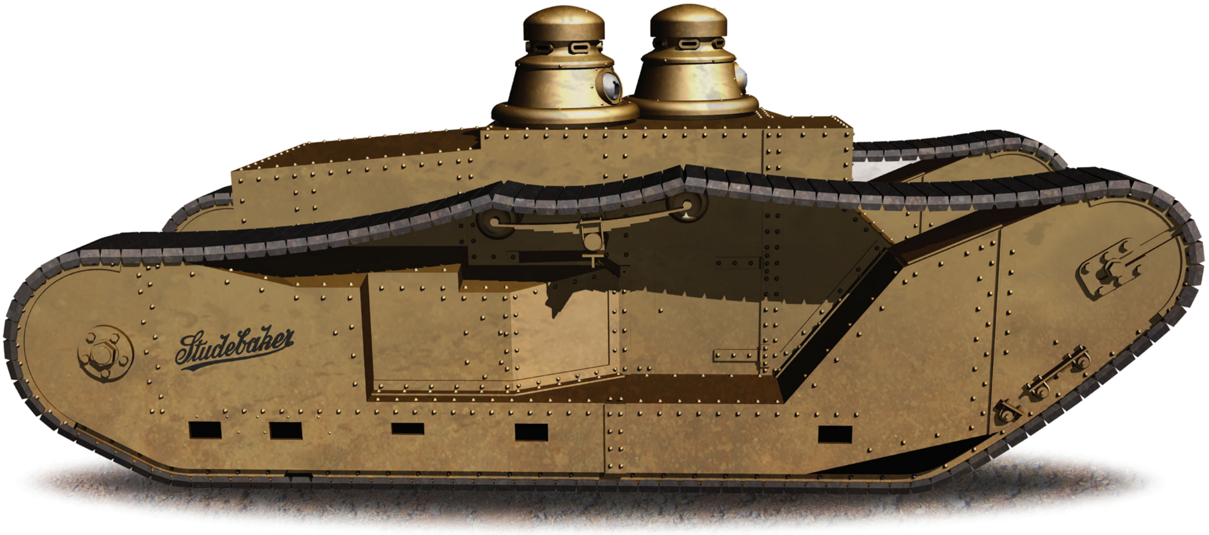
Medium D

Looking unlike any tank ever seen before, the Medium D and its derivatives were a revolutionary step in tank design. Designed by Lieutenant-Colonel Philip Johnson and built by Wolseley Motors of Birmingham, a Vickers subsidiary, and powered by a six-cylinder Siddeley Puma aero engine, the Medium D was fast for its time, but not always reliable. A crew of four occupied the structure at the front; the driver sitting above and behind them, although at this stage his armoured head cover has not been fitted. The wire rope suspension is hidden by the track frames; note that these are higher at the back than the front. The tracks can however be seen, narrow steel shoes with wooden inserts threaded onto a wire rope core.

Johnson never regarded the Medium D as a finished tank design, only as a testbed to try out the experimental suspension and tracks. Most of these tanks were soon scrapped, although one remained for some years as an exhibit in the original, open-air Tank Museum at Bovington. It was ultimately broken up and none survive today. (Art by Henry Morshead, © Osprey Publishing)

The Medium A Whippet modified by Philip Johnson for high-speed running, with sprung suspension, a 360hp Rolls-Royce Eagle engine, and Mark V transmission. In this form it is reputed to have achieved 30mph. Quite where it was photographed is uncertain.

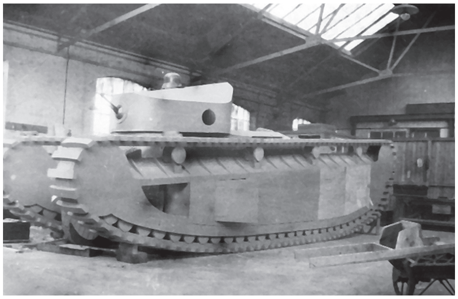




Studebaker Light Tank

Although not directly connected with the Medium A, the Studebaker tank was probably considered as a successor. It was designed by two British officers attached to the British Tank Mission in Washington DC, who had already been offered a number of 110hp Hall Scott aero engines that they thought would suit a light tank. The Studebaker Corporation of South Bend, Indiana, was already well known as a carmaker and had become involved in the production of a small and simple supply tractor, based on the British Newton Tractor and produced on behalf of Sir Percival Perry, head of the British Tank Mission. The new tank would use the tracks and running gear of this tractor.

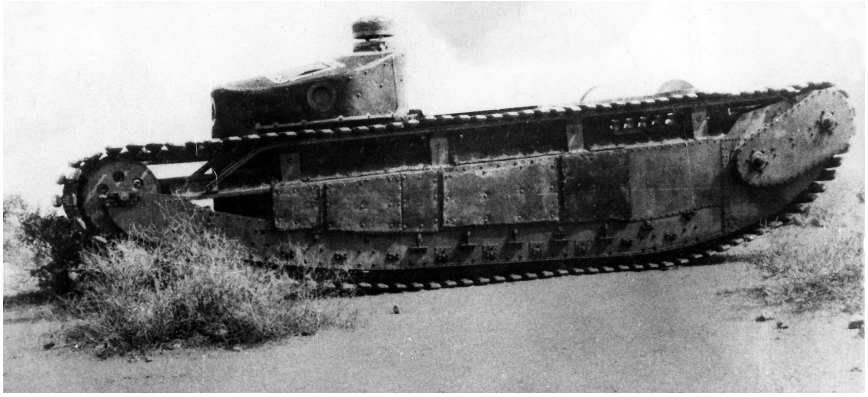
A photograph of the tank outside the Studebaker factory shows it with two small machine-gun turrets on top, but these appear to have been removed by the time the tank arrived in Britain. It was photographed in this form a number of times, but there are no surviving accounts of any trials and one suspects that with the end of the war it was quietly done away with. (Art by Henry Morshead, © Osprey Publishing)



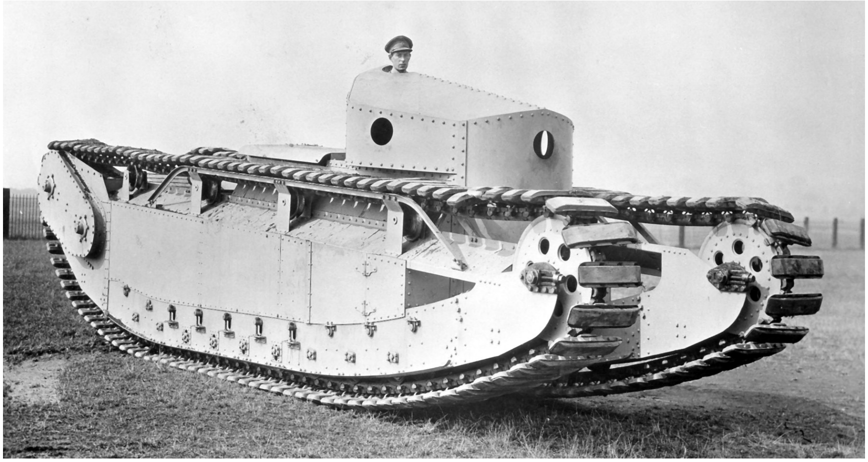
A full-size wooden mock-up of the Medium D showing the unusual layout, which condemned it in the eyes of many 'experts'. In fact, it was only ever meant to be a test bed for some revolutionary ideas. For some reason the mock-up was fitted with real weapons and mountings.

Once the tank was on a flat surface again, the spring and cable forced the suspension to level out. Johnson also came up with the idea of threading the track shoes onto a loop of wire rope that ran around the suspension. This caused the track to bend around the curve as the tank steered, reducing the side thrust on a conventional machine and making steering easier. These ideas were first tried on a modified Mark V heavy tank, and then applied to a new tank of Johnson's own design. This was the Medium D. It was such a revolutionary design that an officer from Tank Corps HQ in France, Major Giffard Le Q. Martel, came over to Britain to inspect the full-size wooden mock-up.

Even when it first appeared, it seems obvious that nobody was ever likely to mistake the new tank for anything else. It was very distinctive. The crew compartment

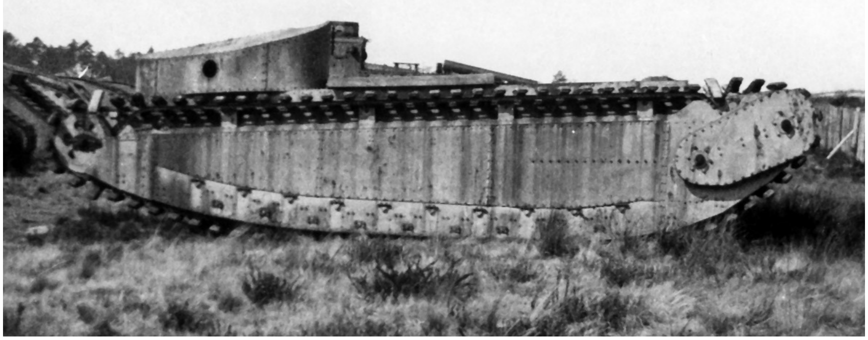


One of the original Medium D tanks that Philip Johnson took out to India. It is clad in panels of asbestos in an effort to reduce the heat. It was also suggested that the tank should be sprayed with water to keep the heat down, but nobody explained where the water was supposed to come from.

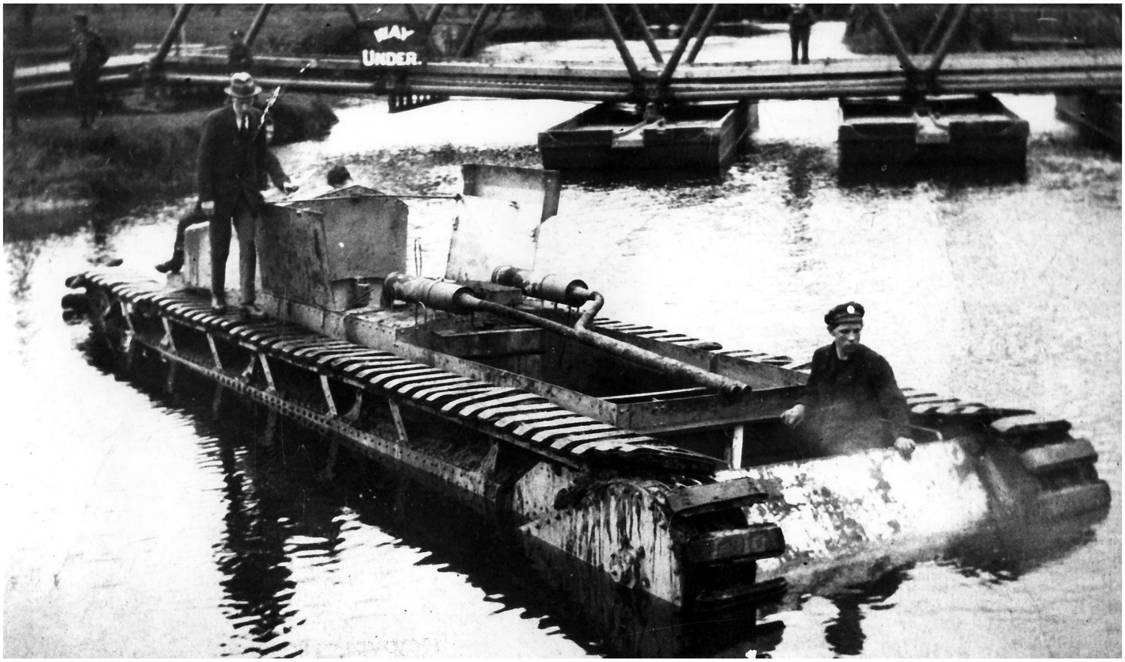


An original Medium D tank before being fitted with weapons mounts or a head cover for the driver. This photograph emphasizes how narrow it was, which is why it was reckoned to be unstable in the water. It has, however, a very striking appearance when compared with wartime tanks.

at the front was essentially oval in plan form with mountings for three Hotchkiss machine guns, one at the front and one each side. Above and behind them sat the driver, for whom a cupola was provided, although there was no similar facility for a commander unless this duty devolved upon the driver; however, as Johnson was at pains to point out to his critics, the tank was really no more than a mechanical test bed, and other matters could be attended to once these basic problems had been solved. Another curious feature that an observer would note is that the rear drive sprocket was set rather higher than the idler. This was a typical Johnson feature and said to be arranged so that the tank could tackle a difficult obstacle in reverse.



The Medium D* (‘Medium D star’), which was photographed in the original open-air Tank Museum at Bovington. What looks like an extension of the cab is in fact part of a Medium C tank parked alongside. Although it was wider than the Medium D, this is not obvious from the photograph.



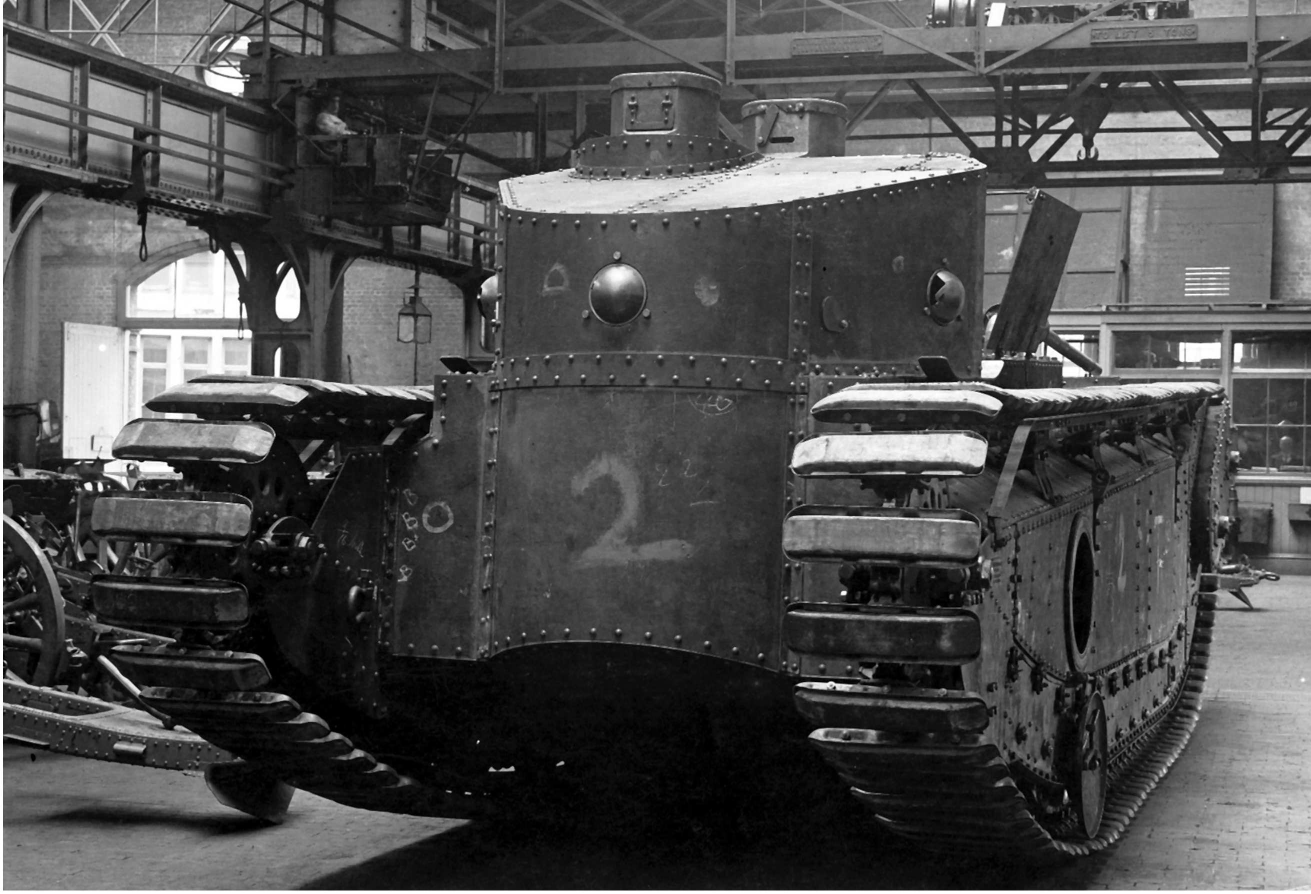
The Medium D** ('Medium D two star') afloat in the river at Christchurch during an amphibious trial. Walking along the tracks is not recommended; they were used to drive it along in the water. This version was both wider and longer than the original, which is why it floated a lot better.

The Medium D was powered by a 240hp Siddeley Puma aircraft engine, a water-cooled straight six. The transmission, upon which Walter Wilson was consulted, involved three-speed epicyclics on each output shaft that provided gear changing and graduated steering facilities. These controls are all said to have been hydraulic. Every effort was made to keep the weight down in the interests of speed and because, in line with Johnson's creed, the tank was intended to be amphibious. Armour was therefore limited to 10mm around the crew and 6mm elsewhere, resulting in an all-up weight of 13½ tons. Tests conducted by the Admiralty at Johnson's request suggested that the long, narrow tank would be unstable in the water.

All told, ten prototypes were ordered: four from Fowlers of Leeds (two of which were never completed) and six from Vickers through their Wolseley subsidiary in Birmingham. Of these one was apparently destroyed by fire at Christchurch, two were sent out for trials in India, and two more were completed as improved models. The fate of the others is not recorded.

The Medium D* looked very similar to the Medium D, although in fact it was wider, at 8ft 5in instead of 7ft 3in, to improve stability in the water. However, it was still not good enough to satisfy the Admiralty. It is also reported to have had four-speed epicyclics in the transmission, all of which increased the weight by one ton. Its service career is not recorded, although it ended its days in the open-air Tank Museum at Bovington.

To some extent the Medium D** could be regarded as a completely new tank, although it was assembled from parts intended for a cancelled Medium D. To begin with, it had been widened to 9ft, which at last ensured that it was stable in the water, and was nearly 2ft longer. It was powered by a high-compression version of the Siddeley Puma, which delivered 300hp, and the transmission involved a primary four-speed and reverse gearbox with experimental Rackham clutches on the output shafts for steering. Weight had now increased to 15 tons. In 1921 it was sent for conversion, and when it emerged again it was equipped with a 370hp Rolls-Royce



The Medium DM (or D Modified) tank, probably photographed at Farnborough. The number 2 on the front was the number issued by the Tank Testing Section. This tank featured two cupolas, one for the commander and one for the driver, each of which seems to have obscured the view of the other.

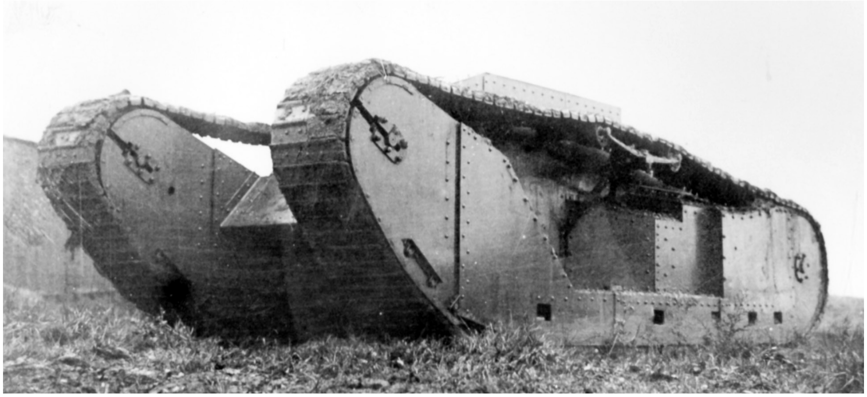
engine and a Williams-Janney hydraulic steering system and final drive, which had already failed in other tank trials. It does not appear to have done any better this time, being recorded as ceasing running in August 1922 and as being broken up about three years later.

The final manifestation of the Medium D appeared in the form of the Medium D Modified (or Medium DM), two of which were delivered by the Ordnance Factory at Woolwich in August 1921. Johnson by this time had been appointed head of the Department of Tank Design and Experiment, located at Charlton Park near Woolwich. Both tanks were powered by a 260hp Rolls-Royce Eagle V12. Although it is claimed that each tank had a different transmission for trial purposes, neither type is specified.

One feature that Johnson may have introduced to satisfy his critics was a second cupola, presumably for the tank commander, situated alongside that provided for the driver. The Medium DM was also amphibious, although one of them sank in the river Thames and had to be fished out. Both tanks were sent to the new Tank Testing Section at Farnborough in August 1921, where they are recorded as ceased running a year later and subsequently broken up.

Although this ended the medium tank saga, it should be noted that Johnson persisted in designing and building prototypes for a year or so in the face of increasing financial stringency before his department was closed down and the project dropped.

The Medium D was visualized by the Tank Corps' tactical eminence J.F.C. Fuller as the epitome of his war-winning Plan 1919, and he clung to this despite mounting evidence of its unreliability. Indeed at one point while in the War Office Fuller records that in pursuit of the ideal tank for Plan 1919 he was torn between increasing



The Studebaker tank photographed in Britain, now without its two machine-gun turrets. For some reason the photographer elected to take photographs of the Studebaker from a very low angle, which over-emphasized its size. In reality it was quite a small tank. Compare this picture with the illustration of the tank in its original form (see page 137).

the supply of Medium C tanks or investing the available funds in the unproven potential of the Medium D. He decided in favour of the latter, and was spared embarrassment only by the ending of World War I.

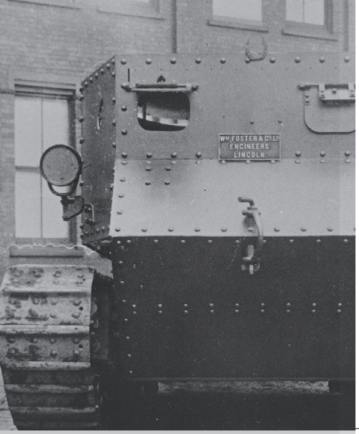
THE STUDEBAKER TANK

Although it was essentially a light tank, the Studebaker tank was clearly intended as a rival to the Medium D, and as such deserves mention here. In the summer of 1918, staff at the British Tank Mission in Washington were offered a quantity of Hall Scott four-cylinder, water-cooled aero engines rated at 110hp, which they believed would also be suitable for tanks. As a result, two British officers serving with the mission came up with the design of a light tank and asked the Studebaker Corporation of South Bend, Indiana to produce a prototype.

Among those involved with the Tank Mission in Washington was Sir Percival Perry (knighted 1917), who before the war had managed production for the Ford Company in England and built it up to be a highly popular brand. A factory had been established at Trafford Park, Manchester in 1911, which was taken over by the government in 1914 and Perry became deputy to Vice-Admiral Moore at the Mechanical Warfare Department. By 1918 Perry was operating out of Washington in charge of production of a very basic tracked load carrier for the British Army, known as the Newton Tractor in Britain after its inventor Colonel Henry Newton. The plan was to take advantage of American production capacity and manufacture large numbers in the United States.

Orders were placed for 10,000 machines with Buick and 5,000 each with Willys-Overland and Studebaker. The tank was to be based upon the same technology, albeit with a fully armoured body and a much more powerful engine. Perry's involvement in the design of the tank is not entirely clear, although a sentence in the *History of the Ministry of Munitions* states 'Sir Percival Perry left for the United States on 31 August 1918, and part of the work undertaken in his American offices was the development of an experimental fighting tank designed to use the 110hp Hall-Scott engine as a power unit'. A photograph taken outside the Studebaker plant shows the tank with two small machine-gun turrets, one behind the other, on top of the superstructure.

The tank was certainly completed and shipped to Britain, but details are few. It is credited with a top speed of 12mph and presumably required a minimum crew of three, but no other technical details survive. Photographs of it in Britain appear to show that the two turrets had been removed, but whether it was tested and rejected, or the premature end of the war caused the order to be cancelled, is not known.



CHAPTER 6

WARTIME PROTOTYPES

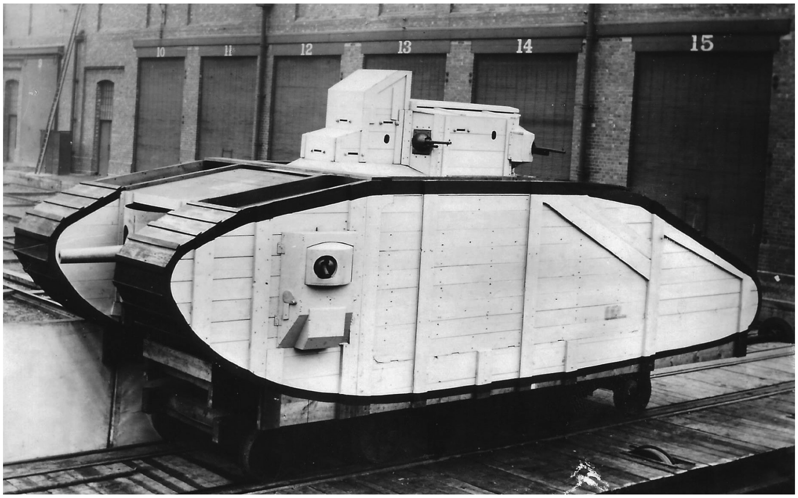
Marks VI, VII, Heavy Mark VIII, and Mark IX

THE MARK VI TANK

The Mark VI only ever existed as a full-size wooden mock-up. Even so, it went through the full design process and came as close to becoming a real tank as any prototypes of the period. The designer was W.G. Wilson and he is said to have started work on it in December 1916 – which seems remarkably early. The new design was quite revolutionary and owed virtually nothing to Britain's previous tank experience, such as it was.

Although it looks a good deal smaller than other tanks it was actually 2in longer than a regular Mark IV, the same width as a female tank, and just 1ft higher. The track plates were widened to 29½in and the space between the inner and outer track frames broadened accordingly. The track frames were also flatter and less rounded than on other marks with a consequent increase in ground contact. This and the wider tracks were presumably adopted in order to reduce ground pressure as a result of experience with tanks over muddy ground on the Somme.

The most significant difference, however, was in the fighting arrangements. No weapon sponsons were fitted, and indeed there were no plans to create male and female versions. Instead a single gun, a normal 23-calibre 6-pdr, was mounted at the front, in the very nose of the tank. In this location the traverse of the gun was limited by the front track horns, giving an arc of fire of 45 degrees, and it naturally displaced the driver. He was moved backwards and upwards so that his cab formed a frontal extension of the superstructure. From here, although his view of the road immediately in front of the tank was obscured, he was able to point the tank, and therefore the gun, in the general direction of the target, leaving the gunner to take care of the fine laying and aiming of the gun.



A full-size wooden mock-up for the proposed Mark VI tank, taken on a traverser outside the Metropolitan Carriage, Wagon and Finance Company plant in Birmingham in the summer of 1917.The real tank was never built, but this wooden effigy is said to have contained a real Ricardo six-cylinder engine and Hotchkiss machine guns.

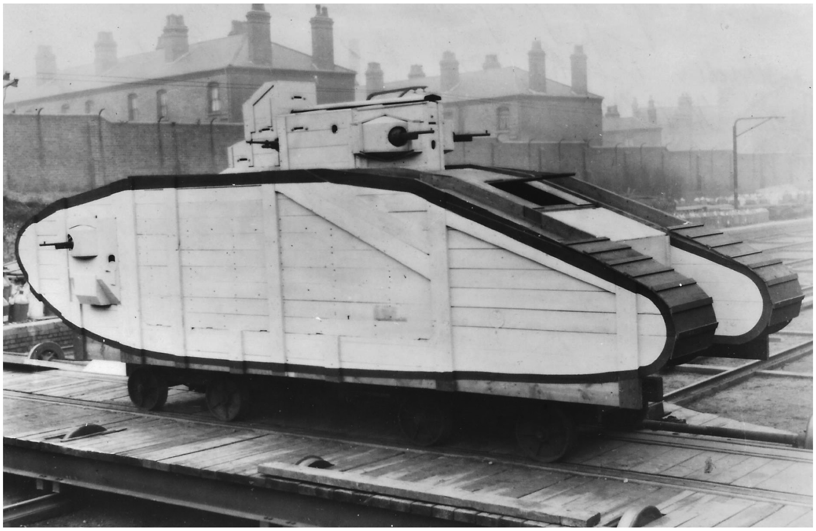
Directly behind the driver's cab was a raised cab with lookouts for the commander, thus taking care of the extra height. Behind that was a longer but lower raised superstructure with mountings for four Hotchkiss .303in machine guns, the two rearmost ones of which were located at the rear corners of the superstructure and enabled machine guns to sweep the whole area to the rear of the tank. Two extra machine guns, a fifth and sixth, were fitted on both sides of the hull, near the front, in mini-sponsons, which doubled as doors and could be removed if the tank travelled by rail, so that they could cover the sides of the tank and almost dead ahead if required.

Because it was vital to leave as much space as possible in the centre of the tank, the engine, a 150hp Ricardo straight-six, was located on the port side near the back and partly within the track frames, with the four-speed gearbox mounted directly behind it. From the gearbox a cross shaft carried drive over to the starboard side of the hull where the two epicyclic units were fitted, one behind the other, within the track frames. The foremost unit drove the tracks on the starboard side, while the one behind it was connected to another cross shaft, running back across the hull, which drove the track on that side. Incidentally, although only a detail which hardly matters on a tank that was never built, the loop of chain from the epicyclics went directly around a sprocket sandwiched between the track drive sprockets, whereas on most tanks the chain drove an intermediate gear that meshed with a gear on the drive sprocket shaft. The locations of the radiator and fan have not been determined, but it is assumed that the main fuel tank, which carried 120 gallons, was between the rear track horns at the back.

Armour, if fitted, would have been to a maximum of 14mm, which was thicker by 2mm than the armour on most other tanks. This brought the estimated weight up to 33 tons, and although this was heavier than any of the earlier models its ground pressure was lower, due to the wider tracks and their new arrangement. And although it was hoped that the tank would have a higher top speed, it was calculated as being only a little better than the old Mark I, at 3.9mph. The proposed crew was still eight men: a commander, driver, gunner, loader and four machine gunners, who would occupy the superstructure and serve the weapons in the hull sides as required.

It is interesting to note that the Hotchkiss rather than the Lewis gun appear to have been proposed, given that the tank's design must have occupied the early part of 1917. It is also worth remarking that despite the early date of the design a Ricardo 150hp engine was specified, along with Wilson's epicyclic transmission.

When Albert Stern was at Heavy Section HQ in France in April 1917, at the time of the battle of Arras, he revealed the general design of the Mark VI to those in authority and left them with a drawing. Stern claimed that he could have a full-size wooden mock-up of the tank ready for them to inspect by 30 April. However a



The same Mark VI mock-up seen from the rear. Notice how the superstructure has been raised to create a sort of fighting top with machine-guns on each corner to provide all-round covering fire and the way the commander's cab is superimposed on the driver's cab with a rear vision slot.

wooden mock-up of the tank, complete apparently with a real Ricardo engine and real Hotchkiss machine guns, was not rolled out until 23 June 1917, outside the Saltley Works of the Metropolitan Carriage, Wagon & Finance Company in Birmingham. Metropolitan seem to have been expected to manufacture the tank, rather than Fosters of Lincoln as stated elsewhere.

No orders ever appear to have been placed for the Mark VI, and therefore no numbers were ever issued. The Americans are said to have ordered 600 machines for their American Expeditionary Forces Tank Corps, but whether from British or American manufacturers is not clear. Indeed there are conflicting opinions on the American order depending upon which source you are prepared to believe. According to Dale Wilson's *Treat 'em Rough*, General John J. Pershing, commander of the American Expeditionary Forces in the field, appointed Lieutenant Colonel LeRoy Eltinge from his staff to investigate tank matters on or around 29 July 1917, while his Tank Board, appointed a few days earlier, recommended that America adopt 2,000 of the French Renault FT light tank and 200 of the British Mark VI heavy tank. But in a cable to the War Department in Washington, dated 14 September 1917, Eltinge proposed that the 600 tanks he recommended ordering be composed of 350 fighting tanks, 20 tanks adapted for signalling, 40 as Supply Tanks, 140 tanks to carry troops (25 men in each) and 50 tanks adapted to carry field guns. This at least shows that Eltinge had grasped the idea of an all-arms formation geared to the adoption of the tanks. However, Eltinge also recommended that the Mark VI be produced in two types – effectively male and female versions, the former armed with a 6-pdr and four machine guns, the latter armed with more machine guns only. Eltinge had failed to grasp a point about tanks that was gradually becoming clear to the British, that all tanks needed at least one 6-pdr gun. The British also agreed to supply the Americans with a complete set of drawings of the Mark VI so that it could be built in the United States. However there is no indication of which engine the Americans proposed to use. Profile Publications' *American AFVs of World War II* on the other hand says that the Mark VI was neither long enough nor powerful enough to meet American requirements.

In the event, however, nothing ever came of this. In America the design process went on for so long that the Americans changed their minds in favour of the Mark VIII when that was proposed in 1918. In Britain the need to continue producing tanks in large numbers meant that the manufacturers were obliged to follow a predictable theme and continue building tanks of a traditional type, rather than embark on anything new that would require total revision of the shape of the track frames and other details. For these reasons the Mark VI, however promising it appeared to be, was a total non-starter.

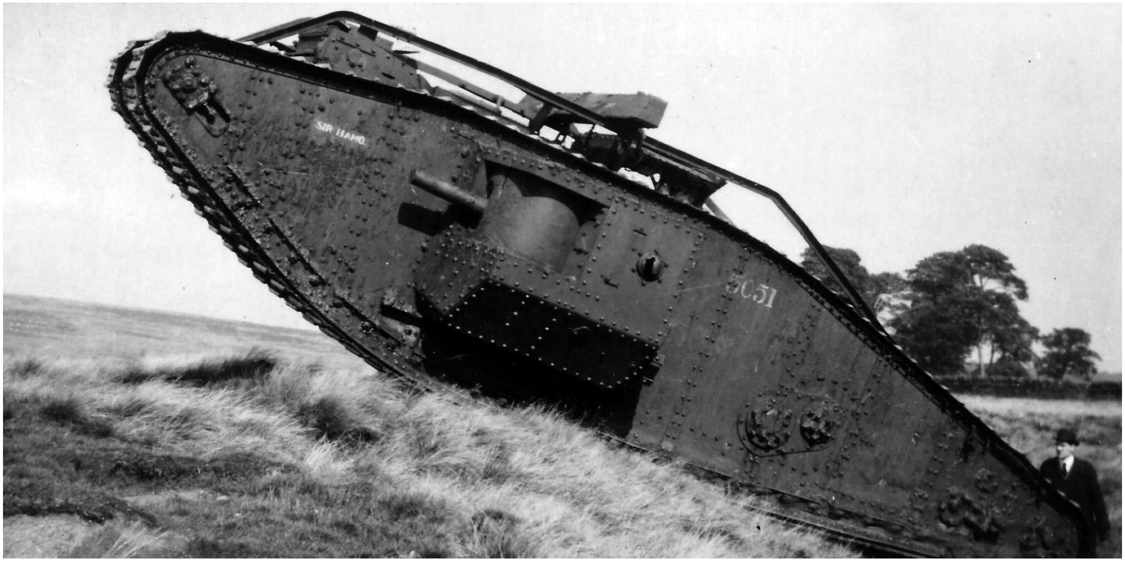
THE MARK VII TANK

Brown Brothers and Company of the Rosebank Ironworks, Broughton Road, Edinburgh, were renowned for the manufacture of ships' steering gear and in particular for the use of the hydraulic machinery manufactured by Williams-Janney Ltd of Crayford in Kent, a Vickers subsidiary. This may be why in 1918 they were selected to design and manufacture the Mark VII tank, to be driven by a hydraulic transmission. Williams-Janney hydraulic machinery had been tested in a tank once before, in a Mark II female which took part in the Oldbury Trials of March 1917, but this had failed on account of the tremendous heat generated by the hydraulic oil within the confines of a tank.

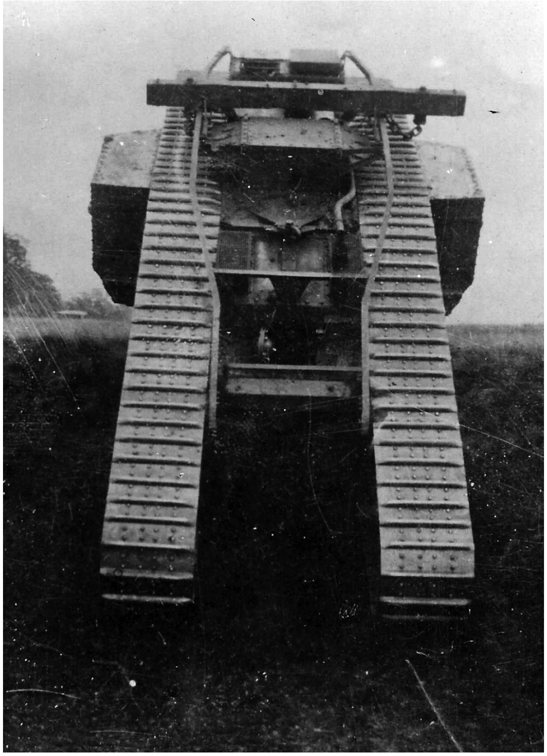
Detailed design of the Mark VII dates from December 1917. The design is said to have been worked out by Major Hugh Knothe as early as November 1916, but supervised in Edinburgh by Lieutenant Oliver Thornycroft RNAS, in conjunction with a Mr Hudd and a Mr John Robson who may have been employed by Brown Brothers. Detailed work on the Williams-Janney equipment must have been left to Brown Brothers on account of their familiarity with it.

Theoretically it was ideal: the tank's engine drove two hydraulic pumps which in turn supplied oil to a pair of hydraulic motors, one driving the track on each side through a gear and looped chain final drive. An adjustable swash plate in each pump controlled the flow of oil and therefore the speed of each motor, which meant that track speed was infinitely variable up to a maximum of 4¼mph. No gearbox was required and the driver controlled both pumps by means of individual hand wheels. Thus in theory driving and steering the tank was perfectly simple. Reverse was obtained by counter-winding the handwheels and it was apparently possible to have tracks going in each direction to create the World War I equivalent of a neutral turn.

The first tank acquired by Brown Brothers seems to have been a Mark IV male, which is understood to have come from Hurst Nelson, the rolling stock manufacturers in Glasgow. Into this they installed Williams-Janney equipment. Photographs show the Mark IV in Redbraes Park, just across Broughton Road from the Rosebank



The Edinburgh-built Mark VII tank, No. 5051, seen during trials in the countryside outside the city. Notice the similarity with the Mark V, even down to the rear cab, although it is also clear that it is longer, with a different arrangement of external bosses covering the ends of the internal shafts. The tank is named *Sir Hamo* after a member of the Thornycroft family, the sculptor.



A Mark VII tank photographed climbing a hill. This angle gives an excellent view of the additional length at the back and some of the extra cooling louvres, necessary to dissipate the heat from the Williams-Janney transmission. Only male versions of the Mark VII were ever built. It is not known if a female version was contemplated, but it would not have been difficult.

Ironworks, although the security measures employed at the time seem rather over the top, as the tank was hardly a secret in 1918. There is snow on the ground and the tank has 6-pdr guns in its sponsons. There is a ventilation louvre on top of the cab, but other modifications to the tank, apart from the special bearings associated with the Williams-Janney transmission, are not visible.

Two Mark VII tanks were produced, 5051 and 5052, both males. Again the hulls are believed to have come from Hurst Nelson, and they were a little longer than a standard tank of the time, about 1ft, with a front cab like that on a Mark IV but a rear cab like that fitted to the later Mark V tank. Additional ventilation louvres were fitted to the top of the hull. The two Mark VII tanks would have been powered by the Ricardo 150hp engine – at least that is what is shown in the official drawing of the tank and mentioned in the official account. The Mark IV, on the other hand, would normally have been fitted with the 105hp Daimler engine, although a Ricardo unit could have been fitted. However the Mark II tank used to test the system during the Oldbury Trials would have had the Daimler power unit.

5051 was then taken on an 80-mile road run that seems to have worn out the tracks and overstretched the engine, but when these were fixed it conducted a 400-mile cross-country test across the moors. A camp was set up where the tank could be attended to and the men looked after at a quarry in the Achinoon Hills on the Lang Whang road to Carnwarth, but although the transmission appears to have behaved faultlessly during these trials all further orders were cancelled.

By now it was too late in the war for the new tank to be of any use, so an order for 37 tanks, placed with Brown Brothers, and a further 35 tanks placed with Kitson and Co. of Leeds, were cancelled. It is interesting to note that neither of these orders makes any mention of a female version, although presumably they must have been considered. The relatively small number ordered may reflect some doubts in official circles about the effectiveness of the Williams-Janney transmission. Or they had sufficient females already, and thus planned to build male tanks only.

One Mark VII ended up in the collection of the Imperial War Museum, while the other was in the Tank Museum's open-air collection at Bovington Camp. Both have since been scrapped.

HEAVY TANK MARK VIII

Known variously as the International, the Liberty Tank, or sometimes as the Allied or Anglo-American Tank, design work on the Mark VIII started around August–September 1917 under Lieutenant G.J. Rackham. This was even before any serious American interest in the type had been expressed. Soon afterwards Albert Stern (knighted in 1918), who had been in charge of tank production at the Mechanical

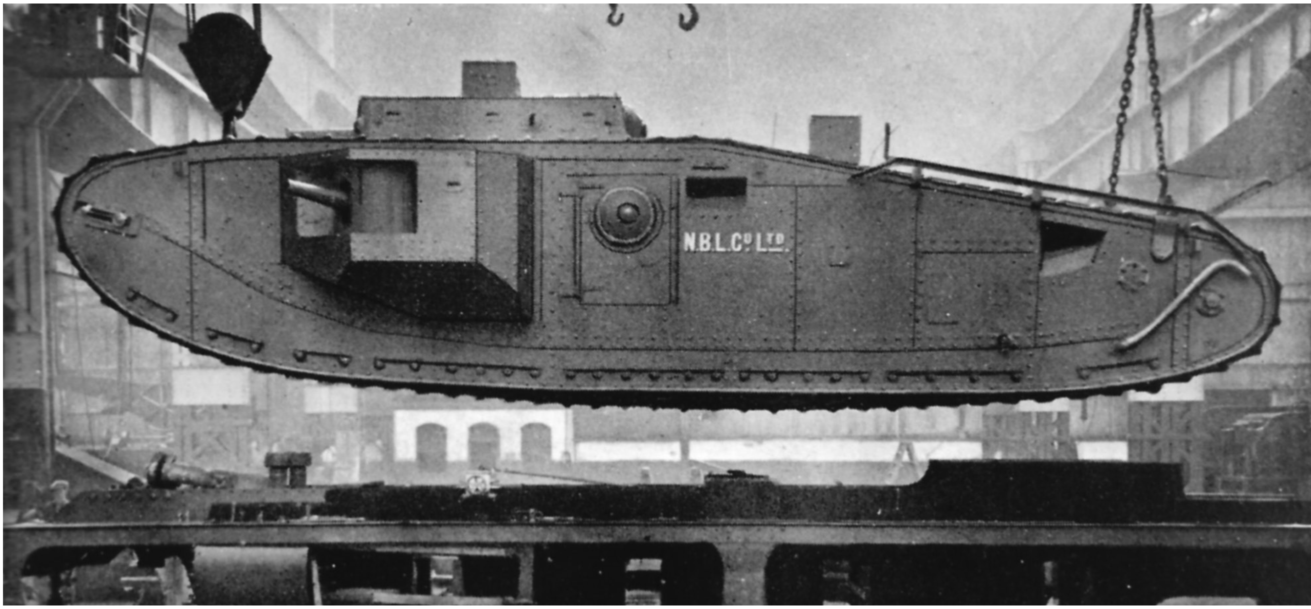
Warfare Supply Department, was dismissed from that position by Winston Churchill and effectively 'kicked upstairs' to become Commissioner for Mechanical Warfare (Overseas and Allies Department), Ministry of Munitions, where once again he became very active in his usual way.

Earlier on, virtually as soon as the United States entered the war in the spring of 1917, Stern had invited the US Military Attaché in London, Colonel Lassiter, to view some tanks. Although the Colonel seems to have been impressed he was too overwhelmed with work to do anything about it at that time. A little later Sir Eustace Tennyson D'Eyncourt (knighted early 1917) invited the US Ambassador − a Mr Page − and some senior US Navy officers to Dollis Hill to view the tanks. The naval party led by Admiral Sims and Admiral Mayo supported by about 40 other officers, were apparently very impressed with what they saw, which led to a suggestion that tanks, in the American services, should be the province of the United States Marine Corps, thus initiating an argument that has been going on ever since.

As noted earlier, the Americans were at first very much taken with the design of the Mark VI tank, which they proposed to build in the United States, but dropped this in favour of a new, heavy tank design which ultimately became the Mark VIII. Meanwhile the British hit upon a plan which would solve the impasse between the War Office and the Ministry of Munitions over what the War Office claimed was the unnecessary over-production of Mark IV tanks, which they blamed on Albert Stern and which was one of the reasons behind his dismissal in the summer of 1917. Since factory space was now at a premium in Britain it was decided to create a plant in France, either by adapting an existing building or creating a new one, where Mark IV tanks could be updated by fitting six-cylinder Ricardo engines and Wilson transmissions, the so-called Mark IV*. However, nothing came of this. Meanwhile two American officers, Major James Drain and Major Herbert Alden were appointed to examine the tank situation in Britain and France with a view to choosing suitable prototypes for American use. They toured various plants in both countries and soon came to the conclusion that for a light tank the French Renault FT – or something based on it – was best, but in Britain they did not really like anything they saw and felt that a new design was the only answer.

James Drain, acting as General Pershing's representative, joined Stern's Allied Tank Commission, while Herbert Alden, an engineer in civilian life, set about drawing up the design of a new heavy tank, ostensibly for the 1919 tank programme. He decided to base its design on the new tank then being drawn up by George Rackham, but with modifications. Rackham, however, was retained on the programme and ultimately produced the 101 detailed drawings required.

Although in essence the Mark VIII design followed on from those of earlier British heavy tanks it incorporated a number of new features that set it apart. For example, the gun sponsons on each side, although containing the usual 57mm 23-calibre Hotchkiss guns, known as 6-pdrs, were a new design patented by Herbert Alden; they had no door at the back but were designed to swing inboard, hinged at the front. Although obviously essential if the tank was going to travel by rail, Alden also had other ideas, for in his patent he specified that it could be employed if the tank had to slim itself down in order to pass along a narrow passage, swinging it inboard would be a much simpler operation than physically sliding the entire sponson inboard as was done on earlier British designs. There were also changes in the tracks: although still the favoured width of 26½in each link was longer by about 5in. As a result only 78 links were required to form a loop on each side rather than the 90 links



A Mark VIII tank on an overhead crane in the North British Locomotive Company's Queen's Park works in Glasgow. The incomplete frame of a locomotive is in the foreground. The Mark VIII was once described as 'the Battleship of the Tank Fleet', but it appeared too late to see service during World War I. Of more than 1,000 tanks ordered from North British less than a score were built, and all but six of them were scrapped.

per side required on the regular Mark V tank. Each link was stamped with a shallow recess in the centre which gave it increased strength. The problem with wider tracks hitherto was that, when mounted on a tank with frames the normal width apart, they lacked support and tended to flex and crack. On the Mark VIII, by placing the frames that much further apart, the 26½in-wide track plates were better supported and less likely to fracture. The diameter of the drive sprocket at the rear was also increased, apparently to reduce the incidence of digging in when the tank was driven in reverse. Also, although hitherto poorly explained, the teeth on the drive sprockets were of the normal type – the reference to a 'roller sprocket' does not mean that the drive sprocket was fitted with rollers instead of teeth, but that the secondary sprocket which took drive by a loop of chain from the transmission had a central toothed sprocket to take the chain with a system of rollers on either side which meshed with the teeth of the drive sprocket. These passed drive to the sprocket but did a lot less damage to the teeth in the process.

In order to keep the overall width of the tank within bounds, so that it was not too wide to travel by rail, the hull between the track frames was made about 1ft narrower, but by cutting back the inner frames on each side there was more effective floor space. The use of excessively heavy internal frames on British tanks was in fact criticized in a report issued by Central Workshops in France at the end of the war. There would be no male and female versions of the Mark VIII tank. All of them were designed to carry 6-pdr guns in male-type sponsons on each side, but a raised superstructure – an extended version of that designed for the projected Mark VI – provided mountings for up to five machine guns that effectively covered the area all around the tank. It also included a raised lookout tower for the tank commander, which enabled him to observe in all directions from the relative safety of the tank. This tower could not rotate, as claimed in one source, but it was retractable and could be withdrawn into the hull in order to reduce overall height for rail travel. Inside the tank was a large container for 6-pdr ammunition in the centre of the fighting compartment and, being flat on top, this provided a raised platform that could be used by machine gunners and the tank commander if required. An electric fan was provided to maintain slightly increased air pressure in the main fighting compartment in order to keep fumes out, but no special arrangements were made to expel this air. There were no machine-gun mountings in the sponsons themselves, but hull access doors in each side of the tank, just behind the sponsons, included machine-gun mountings behind hemispherical shields which could effectively cover both sides of the tank. These doors could also be used for access by up to 22 infantry passengers if required, and for loading the infantry's spare ammunition and other stores.

The track frames were much fuller and more rounded at the front than they had been on previous British tanks and the driver, sitting between the frames close to the front, had a good view ahead, although his view on either side was somewhat restricted by the tracks. In front of him were a pair of steering levers and on either side two pairs of additional levers, the two innermost ones being selectors for the epicyclic gears and the two outer ones a forward and reverse selector (on the right) and a clutch lever for use in conjunction with the latter (on the left). This was the only conventional gearbox in the tank. For normal driving the epicyclics were used, either as change-speed gears or for steering. This meant that the big tank had only two speeds for forward or reverse driving, which was criticized by some British experts who believed that four speeds would be more useful.

Another innovation, at least in a heavy tank, was the location of the engine in a separate compartment at the back. This meant that it was less of a nuisance in the fighting compartment and less likely to pollute the atmosphere in the crew compartment. Two sliding doors and an opening hatch in the bulkhead that separated the two areas provided access along both sides of the engine for maintenance when in motion, and ventilation was provided by a fan that drew in air from above and ahead of the engine and expelled it through the roof a little further back, after it had passed through an overhead radiator. Fuel was carried in three 80-gallon tanks located under armour between the track frames at the back and delivered under air pressure.

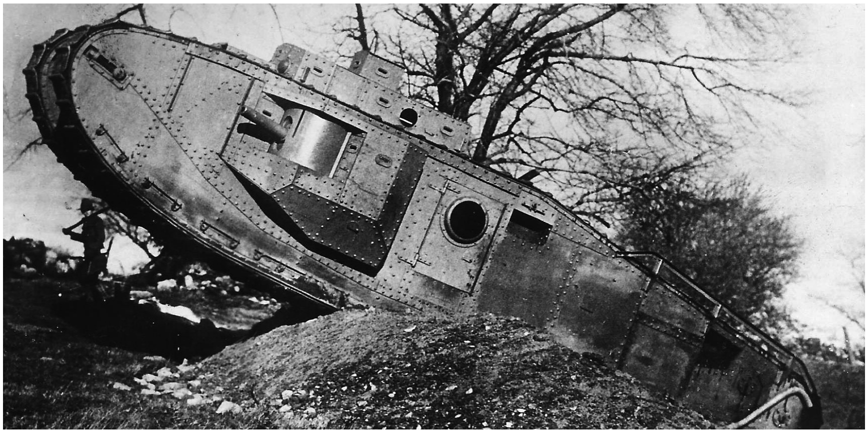
Following criticism that earlier British tanks became seriously underpowered as they got larger and heavier, it was agreed to install a 300hp V12 engine in the Mark VIII. On tanks built for general Allied use or for American service a water-cooled version of the American Liberty engine was selected, but although the Liberty had been designed and built as an aero engine with steel cylinders, it was decided to make a cheaper version with cast-iron cylinders for use in tanks. While the demand for aero engines was so high delivery of the tank versions was delayed, and the British feared a shortage of Liberty engines, especially given the risk of losses from U-boat attacks when they were shipped across the Atlantic. They decided it might be wiser to develop their own V12 for the 1,450 Mark VIII tanks they proposed to build for their own use, in addition to those ordered under the Allied programme. As a result Harry Ricardo was requested to come up with a design for a V12, which he did by adapting a pair of his 150hp straight-six engines into a V12 configuration which would also deliver 300hp. But while this was being developed a Rolls-Royce aero engine was temporarily adopted for the prototype British Mark VIII.

Installing the engine at the back altered the centre of gravity of the tank, while having a bigger engine in a separate compartment meant that the rear end of the tank was much longer and lower than any tank designed so far. In fact, at 34ft 2in the Mark VIII was a very long tank, 2ft longer even than the Mark V**. Ground clearance was also increased compared with other designs, to 1ft 9in. Armour varied from as much as 16mm at the front to 12mm and 10mm on the sides, down to 6mm in less vulnerable areas such as upper-facing surfaces. The original exhaust pipes, located on each side, were routed down below the tank from the engine. This was found to make the floor uncomfortably hot so the pipes were reworked to emerge above the engine, running down to exhaust near the back, which solved the problem. The Mark VIII weighed 37 tons in fighting trim.

The idea was that those tanks, 3,000 of them to begin with for Allied use, should be assembled in France from components shipped over from Britain and the United States. The British were to contribute armour plate and all structural items along with track shoes and rollers, cannon, machine guns with mountings, ammunition and ammunition stowage. The American contribution included all automotive and transmission parts including brakes, all electrical items, track pins and internal links, drive sprockets, wheel and roller spindles and controls. This means of course that tanks built for Allied use would all carry Hotchkiss machine guns. The French contribution to the programme would be a greenfield site at Neuvy Pailloux, near Chateauroux in central France, for the construction of an assembly plant with good rail links to the Atlantic and Channel ports for the delivery of components and to the front for the delivery of completed tanks. The plant was virtually completed although, as it turned out, to no useful purpose. Since labour was a problem for the French, the British agreed to organize Chinese workers to assemble tanks, supervised by British and American foremen. The French did not see providing adequate accommodation for these men as very difficult. However the French soon withdrew from the tank construction programme, partly due to a shortage of men and also because they felt that they had no real need for heavy tanks – although they agreed to take a few just in case. Later, when they heard that the first 600 tanks to be built in France would be going to the US Army, they appear to have altered their view and demanded more tanks for themselves, out of the American portion.

Plans were also prepared for a larger Mark VIII* tank that was to be about 44ft long and capable of crossing an 18ft-wide trench. It was to be extended by 4ft at the front and by 6ft at the back and was expected to weigh about 43 tons, but it never progressed beyond the drawing board.

Meanwhile in April 1918 the British formed the Manchester Tanks Association, a group of 25 local firms under the control of West's Gas Improvements Ltd, who were to manufacture hull parts and other components for the British contribution to the programme. Unfortunately a shortage of materials and labour slowed this process down, and it was rendered more-or-less redundant by the Armistice in November. The Americans decided to build a further 1,500 Mark VIII tanks in the USA for their own use, while in Britain it was decided to build another 1,450 for the British Army. The latter would be fitted with the V12 Ricardo engine and production began in the works of the North British Locomotive Company in Glasgow, but this too was halted by the Armistice. Plans were also afoot to prepare part of the National Projectile Factory at Cardonald in Glasgow to build a further 335 tanks, managed by William Beardmore and Company, while it was decided to order a further 810 from the Metropolitan Carriage, Wagon and Finance Company in Birmingham. In fact no production took place at all except in the North British works, where 24 tanks are said to have been completed, of which six were taken into British service but apparently never used. One of these six was subjected to extensive trials on the roads around Bovington Camp; the fate of the other five is not recorded, although one tank, No. 12007, was preserved and is displayed in the Tank Museum at Bovington. The other 18 completed tanks were apparently scrapped.



Photographed on land surrounding the Locomobile plant at Bridgeport, Connecticut, this is the American prototype of the Mark VIII, or 'International' tank. It was assembled by Locomobile from parts shipped across from England and from mechanical parts procured within the United States, including a 300hp Liberty V12 engine.

The American programme to build 1,500 Mark VIII tanks for their own use never really got underway. However in July 1918 a mild steel hull, believed to be one of those manufactured in Glasgow, was shipped across the Atlantic and sent to the Locomobile Company works at Bridgeport, Connecticut where it was assembled and fitted with the American components. It was ready by 2 February 1919 and was sent to the Savannah Proving Ground in Illinois for acceptance trials. At the same time Colonel Harry B. Jordan, commander of the Rock Island Arsenal, was warned that the hull components for 100 more tanks had been ordered from Britain and would be delivered to Rock Island where he would be expected to complete them. Apparently a further 30 or 40 Mark VIII hulls were completed in Manchester, but it is not clear where the others for the American order came from.

These tanks were all completed, although the Americans, who did not use the Hotchkiss, decided to mount a secondary armament of .30in Browning machine guns fitted with barrel shields. Furthermore it was decided to eliminate the midships gun position on each side of the superstructure, probably on the grounds that the guns in the side doors covered the area just as well. Most of these tanks were used on training exercises and only two modifications are recorded. One involved replacing the fixed commander's lookout with a rotating stroboscope, a French idea which worked well enough but proved vulnerable to machine-gun fire. The other involved one tank being fitted with an air-cooled version of the Liberty engine; the conversion was carried out by the Heat Controlled Motor Company and required the fitting of extra ventilators on the hull side. This tank was an exhibit in the Ordnance Museum at Aberdeen Proving Ground, Maryland until 2010 when it was transferred to the National Armor and Cavalry Museum at Fort Benning, Georgia. Another Mark VIII, without guns, is in the museum at Fort Meade, Maryland.

The crew situation in the Mark VIII is somewhat confused. In the American tanks it is given as 11: a driver, a commander, a gunner and loader on each side, four machine-gunners and a travelling mechanic who is supposed to have occupied a seat inside the engine compartment. However the noise in there, not to mention the heat and fumes, would have made that very uncomfortable. A British Mark VIII on the other hand would probably have managed with a crew of eight: driver, commander, two gunners and loaders and two machine gunners who might have had to hop about a bit. A mechanic would not be required with a British crew.

Those tanks that remained with the US Army were finally declared redundant in 1932 and parked on open ground at Aberdeen Proving Ground. During the early part of World War II some were apparently sent to Canada to be scrapped, but stories that they were supplied for training appear to be false.

After the battle of Amiens and the final period of the war, known as the Hundred Days, it was realized that the era of trench warfare was over, and that while the Germans were retreating they would not have the opportunity to dig extensive trench systems or very wide trenches. As a result there was a sudden interest in shorter tanks such as the ordinary Mark V, production of which had been cut short in favour of the longer Mark V*. This in turn led to a renewal of interest in the shorter tanks and resulted in the design of the Mark X, an improved Mark V that was never built. There was no longer any need for longer tanks, either the Mark V* or Mark V** at 32ft 5in or the even longer Mark VIII at 34ft 2in. Even so, uncertainties surrounding the production of Mark VIII tanks caused the British to place increased orders for the Mark V** as a viable alternative to the Mark VIII. There seems no doubt now that more ordinary Mark V tanks would have been more useful and a more practical proposition, although in the event the sudden Armistice in November 1918 rendered even this unnecessary.

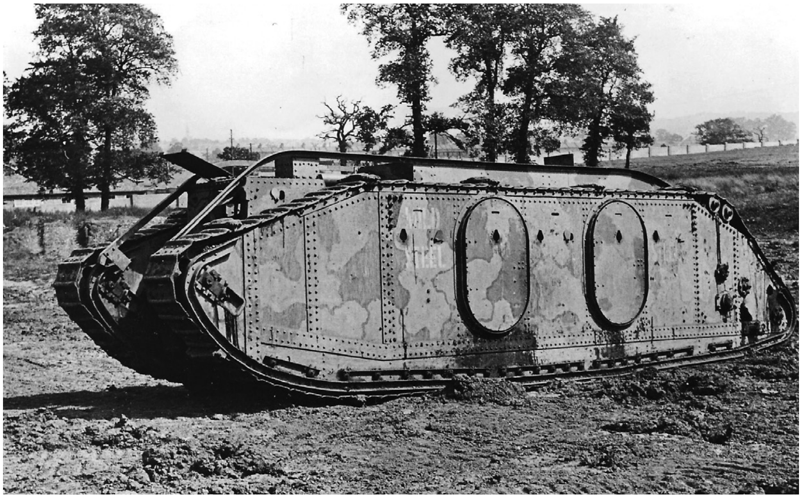
THE MARK IX TANK

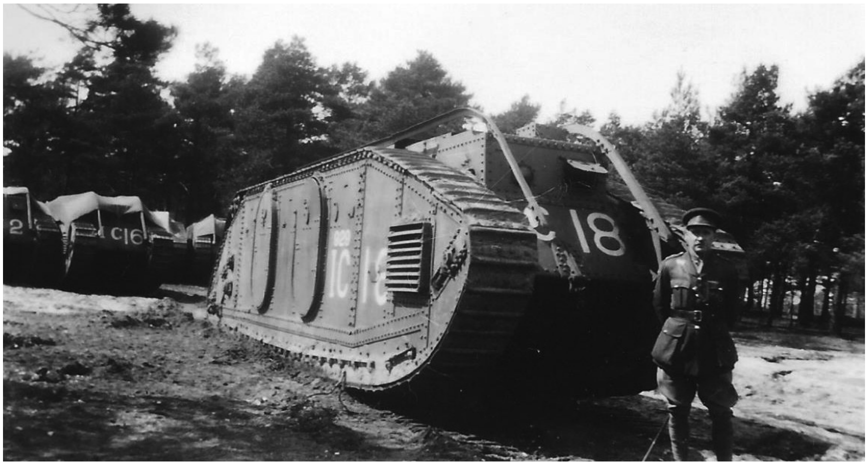
The Mark IX wasn't really a tank at all, but an armoured troop and supply carrier. However, at the time it was classed as a tank, and an initial order for 200 was placed with William Marshall Sons & Co. of Gainsborough, Lincolnshire, although prototypes were built by Armstrong-Whitworth of Newcastle.

Because of the need to create the maximum space inside the tank, the inner track frames were cut away as much as possible, leaving only a single outer skin. Stout steel beams extended across the tank from side to side at floor level to give additional strength. Four large doors, two on each side, were provided for the infantry and for loading stores. The Mark IX carried a crew of four: a driver, commander, and two machine gunners to operate Hotchkiss machine guns at front and back.

The tank's 150hp six-cylinder Ricardo petrol engine was moved well forward and the gearbox and transmission as far back as possible, so that the only thing cluttering up the interior was the drive shaft that ran right along the centre of the tank, just above floor level. The control rods which activated the gearbox and reversing controls ran along the inner face of the roof, with the gear-change and reversing levers located above the driver's head at the front. Rods running back from the steering levers to the epicyclics were channelled along the floor, in a tunnel for protection. The radiator was located in the front right hull side while the crank handle for starting the

The Mark IX prototype finished in a patterned camouflage scheme. One can see the large doors in the side to enable troops to board and dismount, or for loading stores and also the various rifle and machine-gun loopholes. Notice also the large, open, stowage box on top.





This view shows one of a group of Mark IX tanks at Bovington after the war. The letters IC indicated Infantry Carrier and from this angle one can see the louvred panel covering the radiator on the starboard side. Notice also the hinged driver's visor, partly opened, and alongside it the ball mounting for the forward-firing machine gun. Although all Mark IX tanks were fitted with unditching beam rails, one rarely sees them carrying an unditching beam.

engine was located on the left, at 90 degrees to the engine, although electric starting was also available.

As an infantry carrier the Mark IX could accommodate up to 30 fully equipped men who were protected by 10mm of armour plate. However, as there was nowhere to sit they had to remain standing, taking care not to come in contact with the revolving drive shaft. Nine protected loopholes were provided along each side through which infantrymen could aim their rifles. Some of these were equipped with brackets to support automatic weapons, but the loopholes do not seem large enough to accommodate a Lewis gun, the normal infantry weapon, and may only have been able to take the Hotchkiss gun, which was the Tank Corps' favoured weapon. Since conditions inside would have been very unpleasant for the infantry, particularly when the engine was running, a series of vanes was fitted to the engine flywheel; these would act as a fan to disperse any fumes and expel them through an opening in the roof. However, this may not have been entirely successful.

One Mark IX was sent out to Central Workshops in France at the end of the war and it is said to have been fitted out as a mobile operating theatre. Indeed, Mark IX tanks were also considered as ambulance tanks with suspended stretchers inside. Alternatively the tank could handle ten tons of stores inside, with more on the roof and even more on towed sledges if necessary. The size of items carried would be limited to some extent by the shape and size of the side doors.

However, it should be questioned whether such a big supply tank was necessary at all. A standard fighting tank in the supply role could handle about five tons of stores, apparently adequate to resupply five fighting tanks, and with all that shot and shell flying about on the battlefield one feels that might have been enough to invest in one tank. True, in addition to ammunition, fuel and lubricants for tanks the Mark IX should have been able to handle other, equally important military stores, but since none of the new tanks were finished in time to see action it appears that the other arms managed without them.

In fact the priority accorded to supply tanks seems completely disproportionate. In September 1917 Winston Churchill hauled Albert Stern over the coals on this question and Stern made a poor fist of his response. But Churchill's statement that 'I think the supply tank is more important than any other class of tank' seems to be ridiculous – although at the time he was looking for an excuse to get rid of Stern.

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CHAPTER 7

THE END OF THE WAR AND NEW BEGINNINGS

ARMISTICE

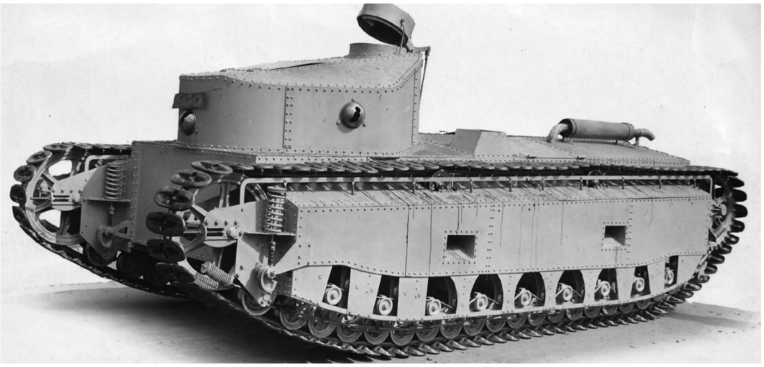
The 11th hour of the 11th day of the 11th month, Monday 11 November 1918, is regarded by most people as the end of World War I, but it was only an Armistice. Germany agreed to stop fighting and withdrew from territory she had occupied, but she did not actually surrender until July the following year. Until then Germany was reviewing her options; whether to start fighting again or seek a permanent peace. In fact Germany was beaten in November 1918, her population was war-weary, and incipient revolution was in the air.

Even so the British reaction to the Armistice was immediate and unequivocal. The situation with regard to tanks is as good an indication as any. By late 1918, the number of tanks available to the British Army had dwindled until it was a shadow of its former self, although great things were promised for 1919. Yet within hours of the news of the Armistice being received, orders were going out to halt tank production. The Army was told to 'live off its fat'. It looked like money would be a problem until Winston Churchill, as Secretary of State for War, managed to coax £220,000 out of the Treasury, which had to be committed by the end of the financial year 1922–23 or it would be forfeit.

The Mark V tanks were still in service, as were Mark V* (many as Supply Tanks) and the new Medium C in small numbers, but the rest were being cut up for scrap. Rows of them stood out on the heath at Bovington (except for those tanks earmarked for distribution as War Savings rewards) while others were being cut up at sites across the country.

THE LIGHT INFANTRY TANK

Only Philip Johnson's new tanks, the Medium D series, were still in production, but they were being heavily criticized by, among others, Brigadier General Hugh Elles,



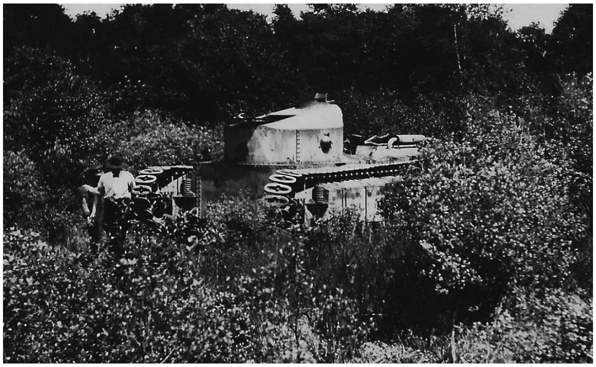
A posed picture of the Light Infantry Tank. The nature of the wire rope suspension and the springs that controlled it can be seen, along with some of the internal pulleys that it relied on, but the most striking element of all is the Snake Track.

head of the Tank Corps, and Johnson himself was starting to fall out of favour. But when Johnson's next tank, the so-called Light Infantry Tank, was delivered to the Tank Testing Section at Farnborough in November 1921, it was probably Britain's first true post-war tank. Similar in many respects to the Medium D series, but much smaller, its title seems to be rather suspect except that it was light, weighing only about eight tons. It was powered by an American 100hp Hall-Scott four-cylinder water-cooled aero engine driving through a four-speed gearbox to Rackham steering clutches, and it ran on Johnson's other new invention, Snake Track. Snake Track was a revolutionary approach to track design; although it was not adopted widely or used for very long, it was a clever alternative to the wire rope system Johnson had been using previously, and was much stronger and more heavily built. With Snake Track each shoe took the form of an oval plate of pressed steel, welded to a segment of tubular backbone. Each segment was joined to its neighbours by a simple ball joint so that each link was free to swivel to any angle, while the complete track not only went round the suspension in the usual way, but was able to form a curve to make steering easier. Its one drawback was that it relied on grease to ease the action, and grease had a tendency to collect grit and sand which together made an excellent grinding paste for wearing away metal.

The Light Infantry Tank managed a top speed of 30mph, which was unheard-of for a tank in those days, and it demonstrated its amphibious qualities on the Fleet Pond in Hampshire. Even so it didn't last very long, being sent back to the Tank Design and Experiment Department in June 1922 and ending its days in the original open-air Tank Museum at Bovington before being scrapped. All that remains of it now is a section of its suspension and a few links of Snake Track.

TROPICAL TANK

At the same time another of Johnson's prototypes arrived at Farnborough. This was his No. 1 Tropical Tank, one of four experimental vehicles built at the Woolwich Arsenal under instructions from the Master General of Ordnance to limit the use of experimental features as much as possible. Thus although it also used wire-rope suspension the tracks were much more conventional with only a limited amount of lateral flexibility. It was powered by a four-cylinder Tylor engine rated at 45hp (effectively a London bus engine) and like the Light Infantry Tank used a four-speed gearbox and Rackham clutches for steering. Weighing less than six tons it was certainly light and thinly armoured, but probably suitable for fighting on the Indian Frontier against tribesmen armed with ancient muskets. It was an untidy-looking design, with a driver's cab at the front, alongside the engine, and two machine-gun turrets further back, the one on the right-hand side leading with that on the left behind it. No weapons were ever fitted, but the apertures look large enough to take a Vickers or Lewis gun. The air-cooled Hotchkiss was never used in India, which



The Light Infantry Tank in close country on the edge of the Fleet Pond in Hampshire where it did its amphibious trials. It was quite a small tank, weighing less than eight tons, but extremely fast for its day and undoubtedly more reliable than other tanks in the Medium D series.

seems to have been the most likely destination for this tank, although it never went there. In fact, having gone to the Tank Testing Section in November 1921 it was returned to Woolwich Arsenal in October 1922 and was never heard of again. The other vehicles in the series were a supply carrier and gun transporter along with an amphibian of unknown appearance, but they were not tanks.

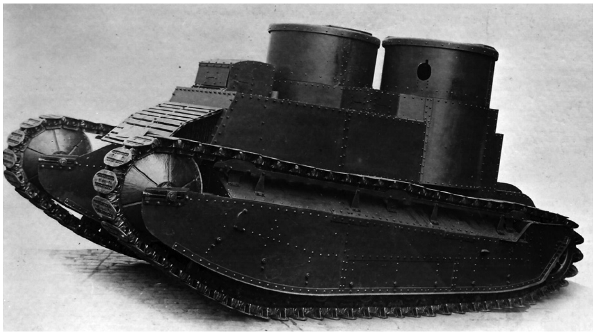
If Johnson had one avid supporter it was Colonel J.F.C. Fuller, despite the misgivings of his own commanding officer, Brigadier General Elles. Since December 1921 Fuller had been acting as a General Staff representative on the War Office Tank Board with the duty of liaising with General Sir Noel Birch, Master General of the Ordnance, and his department. Fuller claimed that he was shocked to discover that the MGO had been negotiating with Vickers to build tanks, behind his back as it were. According to Fuller the MGO had no right to do this without General Staff approval. But by this time the first of the new tanks was nearly ready.

VICKERS TANKS

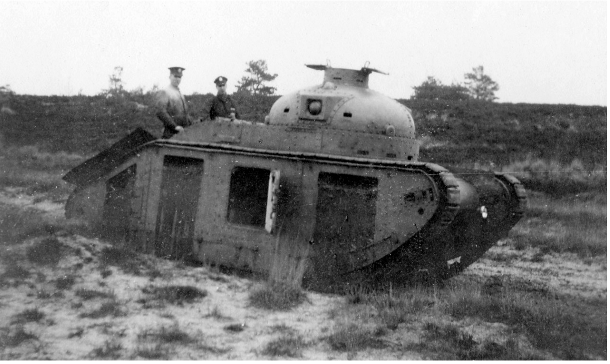
Vickers of Sheffield in those days was one of Britain's main armament producers during the war, although it had never been involved in the production of tanks. One of its subsidiaries, Wolseley Motors of Birmingham, had built some of the prototype Medium D tanks, while Armstrong-Whitworth – with which Vickers would amalgamate in due course – built 100 Mark IV tanks of the standard World War I pattern, but Vickers had never been involved in tank production. It would be starting from scratch.

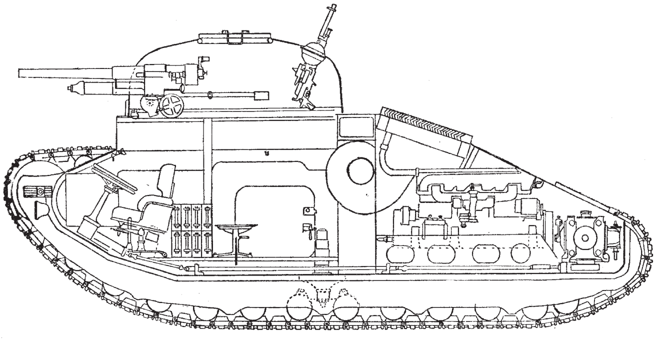
Vickers established a tank design office in London, under the overall control of Sir George Buckham, although the man immediately in charge was Mr C.O. Woodward, about whom nothing is known. Drawing up a new tank for a new concept of warfare was a considerable challenge. All they knew was that it had to be simpler, and more robust, than Johnson's designs, beyond that they could do more or less as they pleased. They were starting with a blank sheet of paper. The site chosen to build the new tanks was Vickers' plant at Erith in Kent, on the Western outskirts of London. The factory at Erith had been the site of the Maxim-Nordenfelt Gun and Ammunition Company, but during World War I it had been the place where the Vickers machine guns and aircraft were made. It was now the place selected to make and fit the armoured bodies to the Rolls-Royce chassis for India and the new tanks.

The Tropical Tank 8-20-10 never went anywhere near the tropics, only to Farnborough where it was briefly tested. Built perhaps with India in mind, it was designed for a crew of three, a driver under the head cover at the front and two machine gunners in the turrets. However, no machine guns, or even mountings for them, were ever fitted, so in that sense the tank was never completed.



The first of these, identified somewhat logically, as Vickers Tank No. 1 (although it was also known as the Vickers Light Infantry Tank), arrived at the Tank Testing Centre, Farnborough, on 17 December 1921. It has been said it resembled the Medium B tank, but with a turret, although this resemblance was only superficial. It was built from plate, 6mm thick, riveted to an





Above left Vickers No. 1 tank, the female of the species, during trials at Farnborough with its engine covers and side door open. No doubt it was very hot inside. No weapons were ever fitted and the tracks are very crude, but this is the first of all Vickers-built tanks.

Above The second Vickers prototype, the male tank armed with a 47mm gun. Notice the simple suspension and the sumptuous driver's seat. This tank was powered by a Lanchester six-cylinder engine, Lanchester gearbox and Williams-Janney final drive.

angle iron frame. Like most later tanks, of which it was effectively the prototype, it was arranged with the engine at the back and the crew compartment at the front. The tank had sprung suspension, but was nowhere near as adventurous as Philip Johnson's system. It consisted of a series of individual units, up to four on each side, with a coil spring inside a tube, which acted on a bogie of four small rollers that ran along the track. It only offered minimum deflection, but was probably good enough for a tank that weighed about ten tons and had a theoretical top speed of 15mph. It was powered by a Wolseley six-cylinder engine rated at 80bhp, a water-cooled unit which should have been powerful enough. However Vickers elected to use the Williams-Janney hydraulic transmission built by Variable Speed Gears, another Vickers subsidiary in nearby Crayford. The Williams-Janney system had been tried in tanks before and invariably found wanting. It is described in the section on the Mark VII tank. In theory it was the ideal system for tanks, since a gearbox was not required and steering could be achieved smoothly by manipulating a couple of hand wheels. Unfortunately it does not seem to have worked very well in the confines of a tank and Vickers were reporting transmission troubles even before the tank left Erith.

The number of the crew is not given, although it can hardly have been less than four. They occupied a roomy fighting compartment, although the commander and machine-gunners had to stand to their work, as only the driver had a seat. The turret itself was dome shaped, topped off by a raised commander's cupola and with mountings for three air-cooled Hotchkiss machine guns around the periphery. There was a fourth position for a machine gun in the turret roof, for shooting at aeroplanes. The turret appears to have been turned manually. The design of the tracks was very unusual; each link appears to be formed from a shallow steel tray connected to its neighbours by two short pins and shackles. The tray itself seems to contain a thin wooden insert, held in place by six rivets, and it all looks too flimsy to last very long.

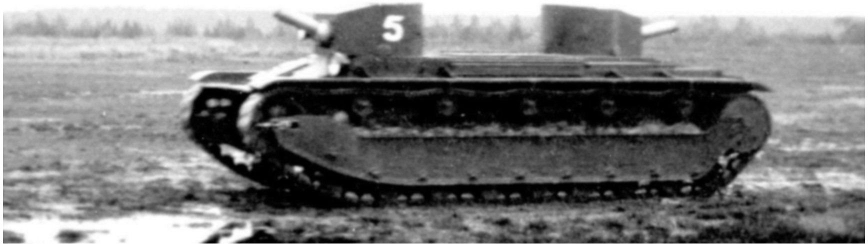
The Vickers tank was the first not to have been designed by Johnson's Department of Tank Design and Experiment to be sent to the Tank Testing Section. However it was not there very long, being returned to Erith in February 1922. While there it was fitted with a more powerful Wolseley engine and new tracks with what appear to be a better gripping surface. It then went back to the Tank Testing Section in October 1922, but is listed as 'stored derelict' by the end of March 1923. At some stage while at Farnborough it is said to have been pitted in a race against Johnson's Light Infantry Tank, which beat it convincingly. This was not surprising if the latter could achieve 30mph while the Vickers tank had a reported top speed of 15mph. However Fuller's somewhat malicious claim that it was also beaten by a Medium C tank (top speed 8mph) probably gives a better idea of its poor progress.

Although Vickers signed a contract to build three tanks, only two were actually completed as tanks. The third one became the Vickers Dragon (a type of artillery transporter) which was built at Sheffield. The second tank (Vickers Tank No. 2) was also built at Erith, but it did not go to the Tank Testing Section until July 1923, probably to see what lessons could be learned from the first machine. Unlike the first tank it was a male machine, with a 3-pdr gun in the turret and only one machine gun, in an anti-aircraft mounting at the back. Otherwise the two tanks looked very similar, except the new one did not have a raised cupola on top of the turret. However their engines and transmission were quite different. The new tank was powered by a six-cylinder Lanchester engine rated at 80hp, linked to a Lanchester three-speed epicyclic gearbox and worm differential driving the cross shafts. A single Williams-Janney hydraulic unit is said to have been fitted above the differential which activated a brake on each half-shaft to effect steering. No report survives as to its performance, but it was probably not much better than the first. It is listed as being disposed of on 17 September 1927 along with a number of other vehicles, including the Vickers Tank No. 1, but by then something much better was being produced.

THREE-MAN LIGHT TANK A3E1

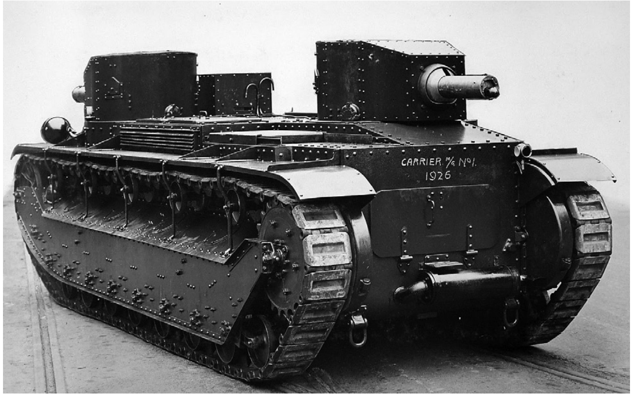
Also known as the Machine-Gun Carrier No. 1, this is a very difficult tank to classify. It does not fit in anywhere. It was built by the Ordnance Factory at Woolwich. It went to the Tank and Tracked Transport Experimental Establishment (or T&TTEE – what the Tank Testing Section had been called since June 1925) on 29 March 1926 as their number 52, but with the WD Number T1021. It took part in the Dominion Premiers' Display on Camberley Common on 13 November 1926, although this appears to have been its only public appearance. It is described in the brochure as being 'an experimental type of machine to carry two machine-guns mounted front and rear and to be inconspicuous. It embodies an effort to reduce the cost of manufacture by utilizing a commercial type of engine and a cheap type of cast steel track'. The brochure goes on to list a weight of six tons 14 cwt, a water-cooled AEC four-cylinder engine rated at 40hp giving speeds of 16mph on the road and 10mph across country; it could climb a 35-degree slope, had a circuit of action of 45 miles and could negotiate a gap 5ft 9in wide. It had a crew of three, listed as a driver and two machine-gunners, and was armed with two machine guns.

The tabulated data in the T&TTEE record lists a four-speed, two-ratio transmission with Rackham steering clutches, built of 12mm plate (representing armour) and an overall length of 17ft 9in, no doubt to give it some trench-crossing potential, an overall height of 6ft 1½in and a width of 6ft 9in, but we are not told



Sometimes referred to as the Three Man Light Tank A3E1 and otherwise as the Carrier, Machine-Gun No. 1, this strange vehicle was seen at the Dominion Premiers' Tank Demonstration on Camberley Common. It was really too big for a light tank, being 17ft 9in long with a machine-gun turret at each end.

what type of suspension it had and this is not obvious from photographs of it. The driver's head occupied an armoured cube at the front, on the right of the vehicle, although this rather limited the traverse of the front machine-gun turret. The rear one had a wider arc of fire, but it is not clear whether the rear gunner could make his way forward inside the vehicle or had to stay where he was. The vehicle was issued to the Superintendent of Design on 27 June 1929, after which we hear no more about it.



A rear view of A3E1, here marked as Carrier, Machine-Gun No.1. Notice the driver's cab to the right of the front turret and how the suspension is hidden by the armour. Was it possible for the rear machine-gunners to crawl forwards, inside the tank, to talk to the other two?

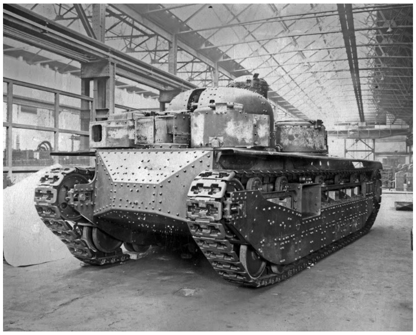
A1E1 INDEPENDENT T1020

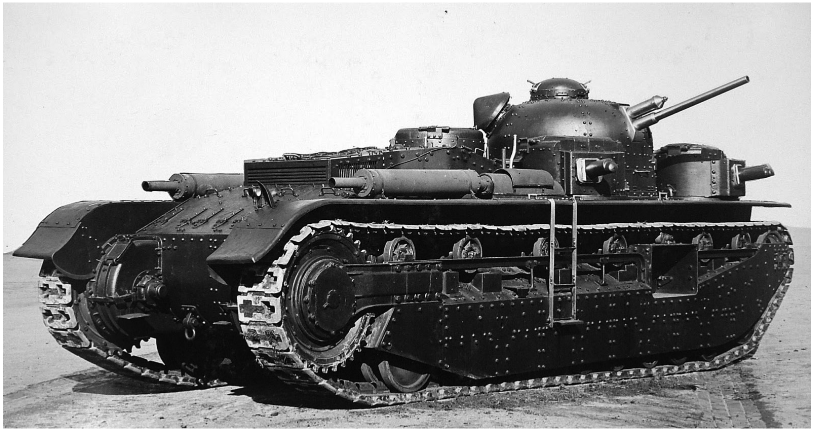
Although it was delivered to the Tank & Tracked Transport Experimental Establishment (T&TTEE) in October 1926, initial specifications for what became the Independent date back to December 1922. The original General Staff specification called for a long, low tank without a turret, with the gun mounted in the nose and machine guns in sponsons on each side. They wanted a rear-mounted engine (with horizontally opposed cylinders to keep the height down) and a trench-crossing ability of at least 9ft with the lowest possible ground pressure. These specifications were then passed to Vickers, which not only drew up something to suit the General Staff specification, but also began work on one of their own, for a multi-turreted tank with a powerful engine, as a rival design. The two sets of drawings were submitted to the General Staff in March 1923, but it was 15 September 1926 (ten years to the day since the battle of Flers-Courcelette saw tanks in action for the very first time) before the contract was signed – in favour of Vickers' design. In fact the matter must have been agreed before that historic date for structural work to begin and for an engine to be ordered.

The Independent was over 25ft long, about the same as a wartime Mark V, but its long, low hull, with a cluster of turrets at the front made it look a lot larger. Even so, since it had to conform to the British loading gauge in order to travel by rail, it was relatively narrow, at 8ft 9in, but the length of track in contact with the ground, coupled with the relatively narrow distance between the two tracks, should have made it difficult to steer, although this is rarely complained about. The Independent was powered by a 35.8-litre V12 Armstrong-Siddeley air-cooled engine (an extended V8, possibly of the 180hp version) rated at 350bhp, which had a substantial appetite for lubricating oil. Drive passed to a four-speed synchromesh gearbox by the Swiss Winterthur Company. It worked on a hydraulic system and required no clutch, although its hydraulic pump gave a lot of trouble. Mention is also made of a conventional four-speed gearbox from a lorry, but it is not known if this was ever fitted.

Steering for large-radius turns was by a wheel in the driver's cab, which acted on compound epicyclics in the drive sprockets. For tighter turns the tank relied on conventional clutch-and-brake steering, worked by a pair of levers in the driver's cab, but this

A factory shot of 'the Independent' being built. It was a massive tank for its day, with a total of five turrets, all clustered at the front. Highly secret when it first appeared, it was later relegated to an experimental prototype and had no issue, at least not in Britain.





As built the Independent was an impressive tank, but it developed weaknesses in its rear end. Notice the large access hatch in the hull side and the ladder for climbing on top. It was powered by a big Armstrong-Siddeley V12 air-cooled engine with a serious appetite for oil.

generated an inordinate amount of heat that warped the brake drums and wore out the brake lining. A special set of tracks had to be made for the Independent, which was similar to but bigger than the No. 3 link type used on some medium tanks; these had to be replaced at one point, and considering the tank only did 630 miles during 11 years of testing this suggests that they wore badly. The suspension also gave a harsh ride. It consisted of four Vickers box bogie units on each side, each with four small wheels and a couple of two-wheeled units, one at each end and again on both sides, fitted with larger wheels. An attempt to fit all these rollers with solid rubber tyres was defeated by the weight of the tank. It proved to be a poor gun platform due, it was said, to the failure to fit shock absorbers. Even so the tank had a respectable top speed of 20mph. At one stage, in an effort to save weight, Vickers suggested that armoured skirting plates over the suspension were not required, but this suggestion was vetoed by the authorities. All-up weight was 31½ tons with armour of 28mm at its thickest.

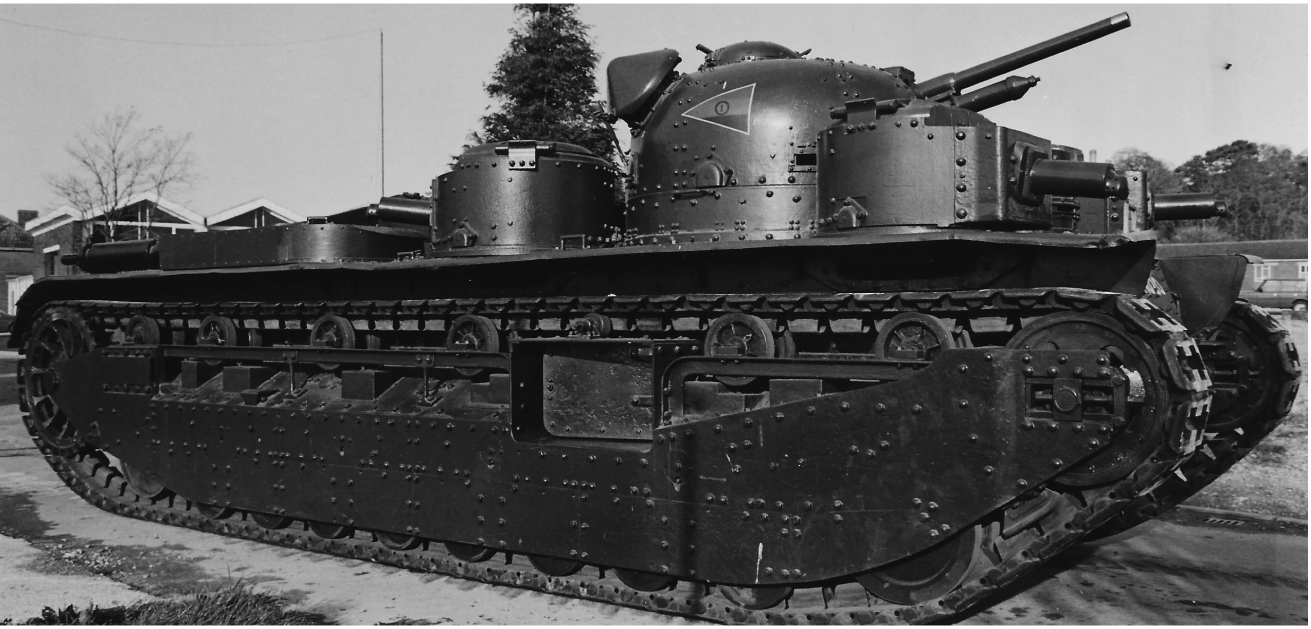
The Independent had a total of five turrets. The central one was dome-shaped and has become the subject of a certain amount of mythology. For example, some sources claim that it mounted a co-axial machine gun, but it never did. Indeed the gun in the main turret looks like a dummy, except inside where the breech suggests it is a real gun; it is the size and shape of a 3-pdr, with the recuperator above the barrel, but apparently made from mild steel. Since there is no evidence of the tank ever undergoing firing trials, this probably did not matter. Some sources suggest that an observer was carried in addition to the commander and that both men shared the cupola, but there is only room for one man in it. There is also a large ventilating fan in a cowl attached to the turret, but this is also quite unsuitable for observing through. Yet another claim, repeated in many sources, says that the commander was provided with a device that showed at a glance which direction every turret was pointing in, but there is no evidence of this either. There is a device in the cupola, driven off the turret ring, that shows the commander which way his turret is pointing, relating to the direction the tank is going in, but that is all. The turret was traversed by hand using a two-speed handwheel, but the platform below the cupola, which is said to have gone round with it, is now missing from the preserved tank, if indeed it was ever there. The turret floor does not rotate as some sources claim.

The four auxiliary turrets, which had limited traverse, each contained a single Vickers machine gun, and although a modified air-cooled weapon was specified, in the event ordinary water-cooled guns were fitted – although none of them are ever known to have been fired. One turret, the rearmost one on the near side, was modified so that its gun could be used against aircraft. This involved an alteration to the top and to the gun mounting, although the chances of actually seeing, let alone hitting, an aircraft from there seem to be very slim.

The driver occupied a central cab at the front, with an auxiliary machine-gun turret on each side. He seems to have been the only one to have a seat. The other seven members of the crew were the gunner and loader for the 3-pdr gun, the four machine gunners who crouched in supreme discomfort in their little turrets, and the tank commander who occupied the main turret. He directed the driver when necessary and, in theory at least, coordinated the fire from his five turrets. The presence of a ninth man, an observer or signaller, cannot be confirmed. To begin with the tank also carried a 10hp engine to be used to start the main engine, but this was later replaced by an Aeromarine inertia starter, which, when wound up until it was whining away, could be clutched in to fire up the main engine, which apparently it did very well. Aeromarine was an American product normally used on Greyhound interstate buses.

In 1928 the rear end of the tank was drastically rebuilt on advice from W.G. Wilson. New drive sprockets were fitted, and in doing so the compound epicyclics were removed. They were replaced by less complicated two-speed epicyclics located further inboard. The steering brakes, which had also been giving trouble, were replaced by new brake drums made from sections of the breech end of 15in naval guns, which were better able to dissipate the heat. Ferodo also came up with some better brake linings, much more hard-wearing than the original type, which seemed to cure the steering problem. Unfortunately it also placed added stress on the track frames, which looked as if they would start peeling away from the rest of the hull. So to alleviate this, a heavy-duty dead axle was placed across the tank at the back, which included a duct for lubricating oil.

Tests on the vehicle continued intermittently until 1935, but in all that time the War Office was never able to say whether the Independent was the prototype of a new class of heavy tank or an experimental test machine. In any case by 1935 it was not only nearly worn out but was a very dated design, so it was relegated to the Tank Museum, where it can still be seen. It now mounts a 3-pdr gun of the type fitted to the Mark I Medium Tank.



The Independent as rebuilt by Walter Wilson and as now displayed at the Tank Museum. A new drive sprocket has been fitted and there is now a tube across the back. Notice the ventilator and commander's cupola atop the main turret.

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CHAPTER 8

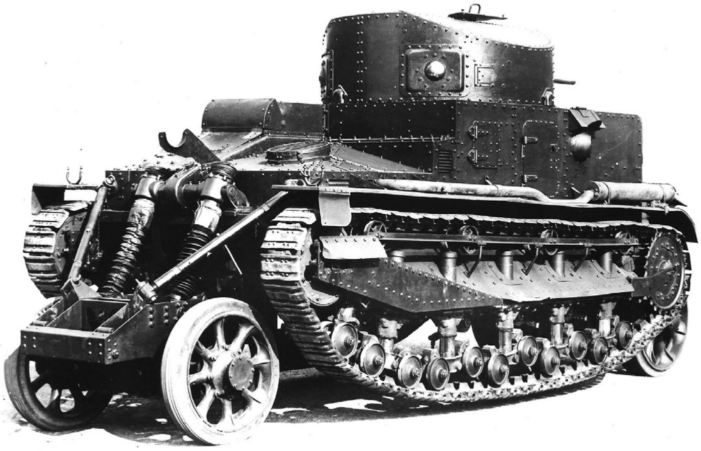
THE VICKERS MEDIUMS

The origins of the so-called Vickers Mediums are shrouded in mystery. We know that they were designed by C.O. Woodward, Vickers' senior tank designer, but we have no evidence at all of the existence of any prototypes as such, nor indeed any clear indication of from where the idea came. Added to which the title Vickers Medium was never officially part of the name. Although designed by Vickers, and many were built by the company, many others were built by the Ordnance Factory at Woolwich. At first they were described as Light Tanks, because at around 12 tons they were a lot lighter than the wartime heavy tanks. Only later, when true light tanks weighing about five tons appeared, were they reclassified as Mediums.

The first of these tanks, WD No. T15 (A2E1), was delivered from Vickers in Sheffield to what was then still the Tank Testing Section at Farnborough on 25 October 1923. It was built from mild steel rather than armour plate and had a few features that set it apart from regular production tanks. Chief among these was the action of the driver's hatch, which was straight at the front and opened and shut like the action of a bread bin. It also lacked the small sliding vision shutter in the vertical front plate of the superstructure, which was a feature of the majority of production tanks.

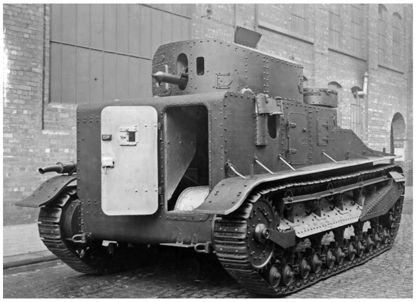
Although the evidence for this is largely circumstantial it seems reasonable to assume that it was this tank, T15, that was converted to wheel-and-track mode and as such took part in the demonstration held on Camberley Common on 13 November 1926, normally referred to as the Dominion Premiers' Demonstration. The actual conversion is said to have taken place at Vickers' Sheffield factory on 6 July 1926. In this form the tank looked chronically unstable. The wheel sets, both front and back, had to fit between the tracks; they were thus very narrow and ran on solid rubber tyres. The front set was used for steering, although it is not entirely clear how, and do not appear to have had any brakes, while those at the rear provided drive, through a power take-off from the gearbox. When raised clear of the ground the wheeled appendages did not detract from the tank's performance, although they added to the overall weight of the vehicle. On wheels, however, braking must have been very poor and its stability questionable, although it is credited with a top speed of 20mph.

The suspension on a regular Mark I comprised five units each side, each unit consisting of a cluster of four small rollers on a vertical tube and spring system as used in the original Vickers tanks. There was also a two-roller unit at the front on each side between the idler wheel and the point where the track makes contact with the ground. This was sprung in the same way, but it was set at an angle to hold the track steady and stop it from bending inwards when the track met a step. Later on some tanks were modified with another two-wheeled bogie at the back, between the rearmost four-wheeled bogie and the drive sprocket. There were also four return rollers supporting the top run of the track; and all of this was exposed to view, there being no skirting plates to hide or protect the suspension. The track was of the No. 9 link pattern, with pressed steel sole plates riveted to cast internal links. It had the unfortunate habit of falling apart after a lot of use, so it was later replaced on some tanks by the stronger No. 3 link track in which each link was a one-piece casting, including the sole plate that, apart from a tendency to fill with mud, was a lot more robust and held together better. For a similar reason the suspension units were later modified, at least the five main bogies, which now had outside frames to prevent the rollers from coming adrift and leaving the path of a tank littered with discarded rollers. It is said that the suspension, lacking any conventional shock absorbers, gave a rough ride at speed, although by using a pair of springs of different lengths in each suspension unit was supposed to have a similar effect.

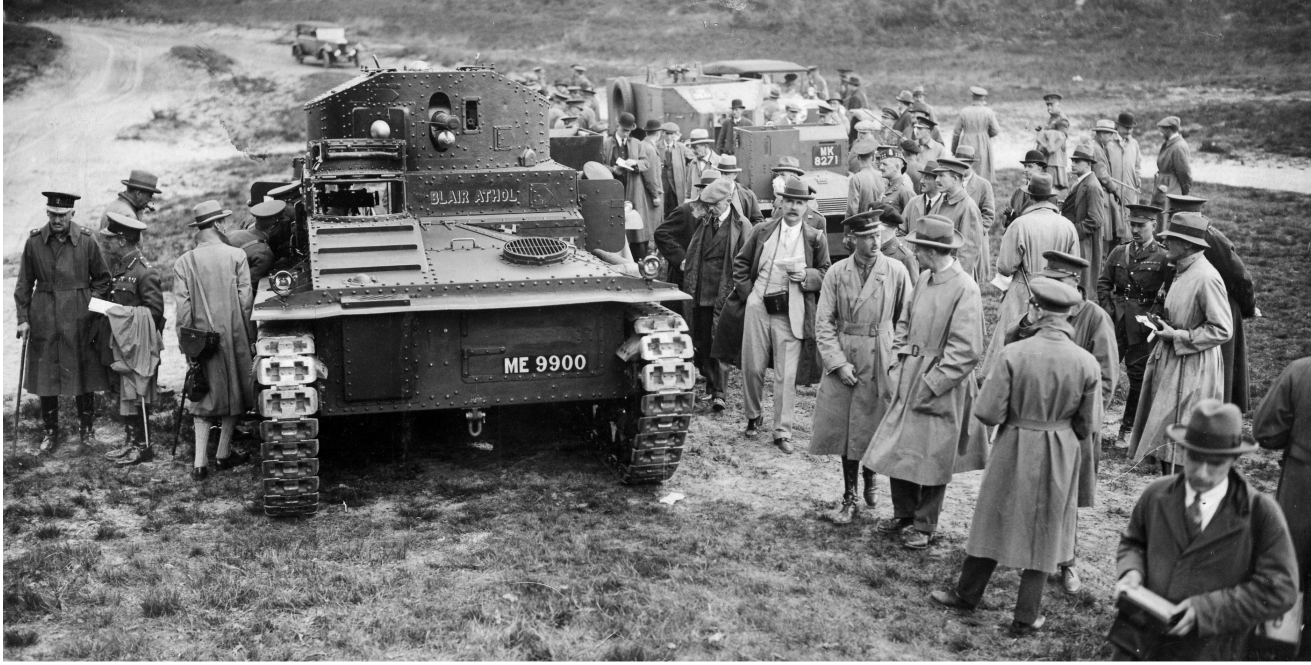


The prototype Light Tank fitted with the wheel-cum-track equipment; it is already looking somewhat unstable. Notice that on this tank the rearmost roller is absent from the suspension and the unusual arrangement of the driver's visor. The suspension is fully extended and the bogies are free to move at their ends.

The Mark I, and indeed all tanks in the Mark I and Mark II series, was powered by a 7.79-litre air-cooled Armstrong-Siddeley V8 rated at 90bhp. It was fitted with steel cylinders (4in x 4¾in) and is said to have been based upon an aero engine, the RAF1A, although naturally it was a lot heavier and the angle between the banks of cylinders was reduced. It was a petrol engine, as most engines were in those days, but notoriously difficult to start from cold; it had an electric starter motor but this only worked when the engine was warm. Otherwise starting the tank (from inside in the case of the Mark I) required a lot of physical effort. Located directly above the engine was a 14in Keith Blackman fan which drew air in from outside and circulated it around the engine to ventilate it. However, since it was under armour, it is said that the fan absorbed a significant proportion of available engine power. Drive from the engine passed, via a heavy duty, multi-plate clutch, back into a regular four-speed-and-reverse gearbox that was situated in the centre of the floor



A new Light Mark I as built, without any armament fitted, showing the large rear door and the shape of the fuel tank inside. This tank features the rearmost roller. The driver's head cover is also open and folded backwards.



Another Mark I seen from the front. This one is in service with 2nd Battalion. It was photographed at a press demonstration on Camberley Common along with some other interesting vehicles. Notice how the driver's head cover opens, partly masking the machine-gun mounting.

of the fighting compartment, covered by a pedestal which provided the tank commander with a platform to stand on, enabling him to see out of the hatch in the top of the turret.

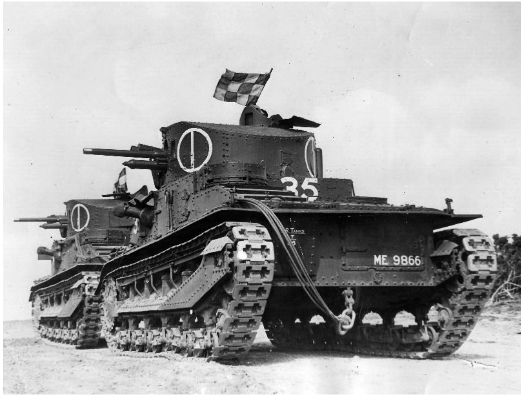
Another drive shaft, from the rear of the gearbox, carried drive to a bevel box at the back, which split it both ways to each side of the tank. Here, just inboard of the sprockets but on a separate shaft, were a pair of two-speed epicyclics that could be used together to provide an emergency low gear or, individually, in conjunction with a brake for steering. Pulling both levers all the way back engaged both brakes and halted the tank. From the epicyclics gears carried the drive to the rear axle and drive sprockets.

The hull was built up from panels of armour plate, 6.5mm thick, riveted to a frame of angle iron. At the front was the engine, under a sloped and suitably ventilated armoured cover. Alongside it on the right sat the driver, whose head cover was a big D-shaped section which folded back for driving away from action, but which had the unnerving habit of slamming shut when the tank went over a bump, with a detrimental effect on the driver's fingers if he happened to be gripping the rim of his lookout to steady himself. Anti-splash rails were fitted across the sloping panel in front of the driver. The rest of the hull was simply an armoured box, with a large door in the back and smaller hatches along both sides. Fuel tanks were located across the back, to the left of the door, with a total capacity of 90 gallons, and arranged so they would empty their contents outside the tank if punctured. These tanks fed a small gravity tank above the engine. Lubricating oil, of which the engine got through quite a lot for cooling purposes, was carried in a 4-gallon (later increased to 13½-gallon) tank.

The turret, which was rotated mechanically, but by a hand wheel, turned on three rollers. The main armament was a 3-pdr (47mm) gun firing solid shot. Known as the Ordnance Quick Firing 2cwt Mark I, the barrel was 31 calibres long with a muzzle velocity of 1,750ft/sec and a maximum effective range of 6,000 yards. It had a vertical falling breech and was elevated by a hand wheel (which was also the firing mechanism for the 3-pdr gun) so that the gunner had to master the art of elevating the gun with his left hand and traversing the turret with his right while tracking a target, since firing on the move was favoured practice in post-war Tank Corps and Royal Tank Corps circles. Air-cooled Hotchkiss .303in machine guns were also available in the turret; for these four ball mountings were provided, three at different points around the circumference and a fourth in the turret roof for firing at aircraft. Two heavy-duty Vickers .303in water-cooled machine guns were also mounted, one in each side of the hull. These were presumably intended for firing down into trenches as the tank crossed.

In all 27 Mark I tanks were built, 14 by the Ordnance Factory at Woolwich and 13 by Vickers at Sheffield. T1 (A2E2), the first of these tanks built at Woolwich, was, like T15 (A2E1), fabricated from mild steel; the rest were all armoured. T1 is said to have been dismantled later for instructional purposes.

Around 1930, T14, the last of the Woolwich tanks, was fitted with a four-cylinder, water-cooled Ricardo diesel engine, model G20. Although it developed 117bhp and gave the tank an increased radius of action (at the expense of blanking off first gear) it does not appear to have improved its performance in any other respect. T14 was subsequently converted back to its original power unit and was later one of two Mark I tanks to be sent to South Africa, where it still survives, the only Mark I tank to have lasted so long. Later two more tanks, T7 from Woolwich and T20 from Sheffield, were tested with Ricardo S90 water-cooled diesel engines, although again in due course both reverted to their original power units. At least two tanks, T1 from Woolwich and T18 from Sheffield, became Close Support tanks. This involved replacing the 47mm (3-pdr) gun with a 3.7in breech-loading mortar, classified as a 15-pdr. Apart from the seemingly indiscriminate changes to tracks and suspension units mentioned earlier, these seem to be the only recorded modifications to the Mark I type.

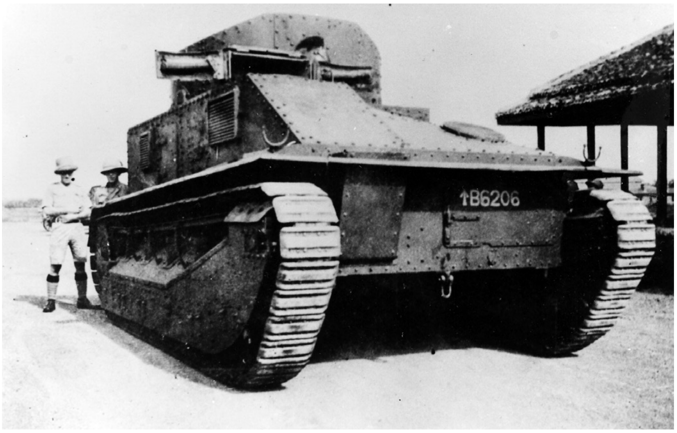


The Mark IA* in its final form with co-axial machine gun, Bishop's Mitre cupola, new tracks and bogies. The driver's head cover is split down the middle and opens outwards, only the top section folds back. Flags are flying and the turrets are trained on the beam.

MEDIUM MARK IA

Production of the Mark IA followed directly upon completion of the Mark I, 14 from the Ordnance Factory at Woolwich (T28–T41) and 17 (T42–T58) from Vickers, bringing the total number of Mark I type tanks built for the British Army up to 58. They were more or less identical to the Mark I with just three minor alterations that are visible from outside: a bevel added to the back of the turret which contained the anti-aircraft ball mounting for a Hotchkiss gun, a modified hood for the driver in which only the top plate folded backwards (the curved vertical plate was split down the middle so that each section swung out sideways when it was open) and a hole in the front vertical plate of the hull through which an engine starting handle could be inserted rather than having to crank it from inside. Inside, the Mark 1A differed by having a pedal-operated flap in the driver's compartment that could be opened to improve ventilation, and a few more cushioned pads to protect heads when looking out. Armour thickness was improved in places, up to 8mm, but it could not have been very much, since it only added a quarter of a ton to the overall weight. As with the Mark I, new tracks and revised suspension were added to some tanks. Although in terms of suspension the Mark IA was identical to the Mark I, the two-wheel suspension unit at the rear had now become a fixed feature.

In 1928 a modification took place that involved only 13 of the Mark IA type, which were reclassified as Mark IA* to bring them into line with the Mark II* and



One of the special tanks sent to India armed with just two machine guns. They performed reasonably well but were not popular. This photograph shows clearly how the driver's head cover opened. Both tanks were shipped back to Britain and duly scrapped.

Mark IIA. It involved the elimination of the air-cooled Hotchkiss machine-gun mountings around the turret and their replacement by a single Vickers water-cooled machine gun alongside the 3-pdr, on the right. This is what became known as a co-axial mounting, since the machine gun elevated and depressed with the main gun and naturally traversed with it when the turret rotated. A selector switch was fitted so that one gun or the other could be fired, but not both at the same time. Since the weight of this modification upset the turret's balance, a lead weight was fitted at the rear to compensate, but because this increased the overall weight the number of roller bearings on the turret ring was increased from three to six. A further modification was the fitting of a rotating cupola on top of the turret for the commander. Known as the Bishop's Mitre on account of its shape, it replaced the flush two-piece hatch in the turret roof; the commander was provided with a leather sling to support him while using it. The original Hotchkiss mountings were plated over with metal discs; the one on the rear of the turret sometimes became the base for a wireless aerial, although there was nowhere inside a Mark IA where a wireless set could normally be mounted.

We now come to a most peculiar pair of tanks that complete the Mark I story. Designated Tanks, Light, Mark I/L Indian Pattern, they were built by Vickers to a contract dated 15 May 1924 and were given numbers T59 and T60 in the War Department system. Both went to the Tank Testing Section at Farnborough in October 1924: T59 on the 9th and T60 a few days later on the 20th. Since both tanks are believed to have been identical this seems rather pointless, but T59 is recorded as going to the Ordnance Factory (for India) on 30 October, followed by T60 a few days later on 11 November. It is assumed that both tanks sailed on the same ship, since they are recorded as arriving in India in January 1925 with a detachment of men commanded by Lieutenant J.T. Crocker, RTC.

Both tanks were most peculiar to look at and outwardly mark a transition between the design of the Mark I and Mark II tanks. The driver's cab is now on the same level as the turret and the armour covering the engine reshaped to suit. On the sides armoured skirting plates cover the suspension right down to track level. So to all outward appearances they resemble a Mark II, yet inside the mechanical layout is said to be identical to that of a Mark I tank. Since an anti-tank gun was of no use in India, the turret, which was flat-topped like a Mark I, carried ball mountings for just two Vickers .303in machine guns, one facing each way, while the two machine-gun mountings in each side of the hull were eliminated altogether. Although one can see the case for removing the 3-pdr gun, there seems to be no obvious reason why a close-support howitzer could not have been installed instead, but it wasn't – no aperture was provided, nor any sort of mounting. On account of the heat each tank was lined inside with sheets of asbestos and an additional extractor fan was fitted in the fighting compartment.

Trials in India appear to have been reasonably effective; the tanks travelled from one military centre to another, sometimes by road, at other times by rail, depending upon the distance, and tackled similar obstacles in each place. Only one such is recorded: a tank failed to climb a shale embankment, only to be overtaken by artillery drawn by a team of horses, much to the delight of the anti-mechanization element.

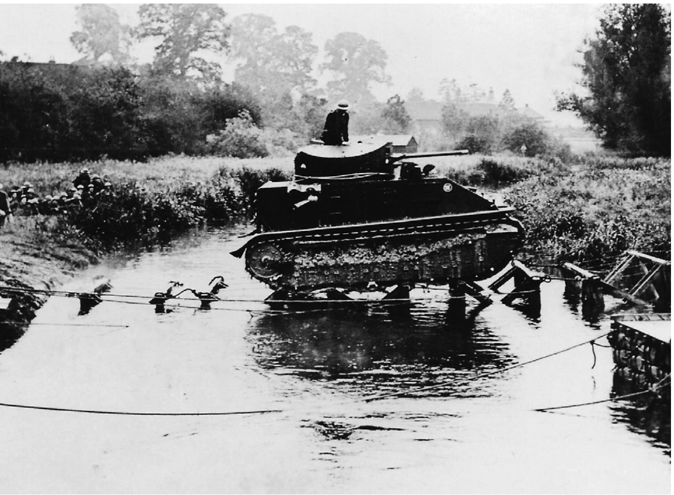
Otherwise the trials seem to have been most successful, but in the end both tanks were shipped back to Britain and duly scrapped. India clearly was not yet ready for tanks, at least not of this type.

MEDIUM MARK II

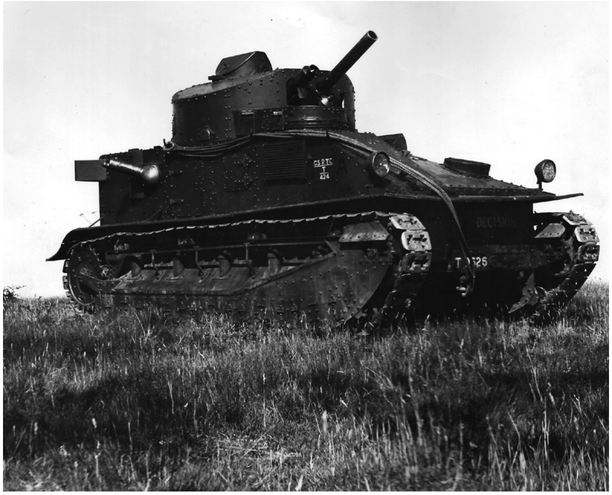
Ninety-one Mark IIs were built if you include the 'Boxcar' and exclude the Mark IIA. Construction was shared between Vickers at Sheffield and the Ordnance Factory at Woolwich between 1924 and 1927. The first one to go to Farnborough was T118 (TTS No. 34). It was delivered from Vickers, Sheffield in March 1925 and issued to Woolwich on 6 November 1932, by which time the Tank Testing Section had become the Mechanical Warfare Experimental Establishment (MWEE).

Although the Mark II was clearly of the same family as the Mark I, it was essentially a new tank. For a start the hull was different. As foreshadowed by the two tanks that went to India the driver's hood was raised, putting it on the same level as the turret, and the front of the hull altered accordingly. The armour plates on each side were continued downwards almost to the tracks, covering the suspension, although five hinged panels were added at each side to provide access to the bogies and rollers. More fundamentally the transmission was modified. From the four-speed gearbox, in its usual place, drive now passed into a two-speed epicyclic box and from there, via a bevel box it passed outwards, in each direction, into a pair of Rackham steering clutches, which replaced the epicyclic steering system of the Mark I. The tank also mounted a Mark II version of the 47mm 3-pdr gun. This had a slightly longer barrel, an increased muzzle velocity of 1,850ft/sec and a slightly improved range, now 7,000 yards as against 6,000 yards for a Mark I. The gun also had a horizontally sliding breech, instead of the vertical drop down type of the Mark I. So to that extent the Mark II was a slightly different tank.

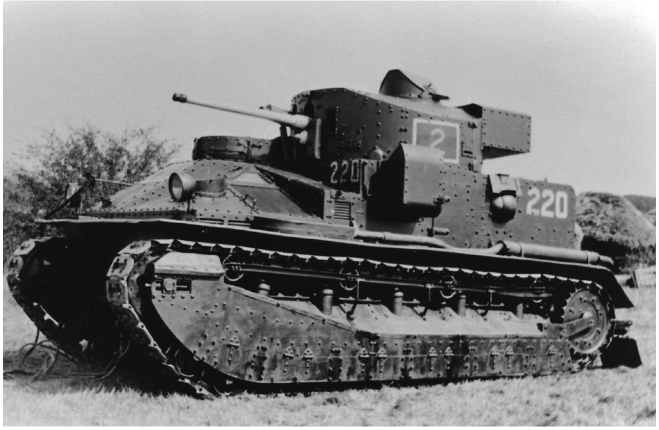
Subsequently all the Mark II tanks were modified, bringing them into line with the Mark IA*. They had a co-axial Vickers machine gun (the Hotchkiss mountings

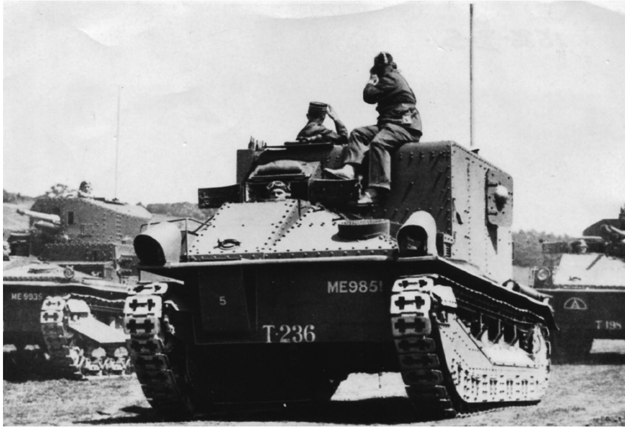


A Mark II tank crossing the Basingstoke Canal on Martel's stepping stones. Notice how the armour now reaches down to cover the suspension, the raised location of the driver's cab and the revised shape at the front.



A Mark II* close support tank mounting a 3.7in weapon instead of the 3-pdr, but here in a co-axial mount with a Bishop's Mitre cupola on top of the turret. The name *Decision* indicates a tank of 4th Battalion, Royal Tank Corps.





A Medium Mark II** with the wireless bustle at the back of the turret and an extra ventilator on the side of the hull. Usually, when the gun was painted white it was to represent a close support tank in an exercise.

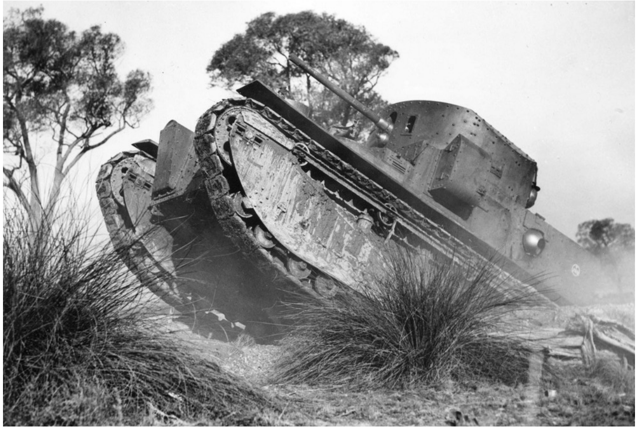
The one and only 'Boxcar' command tank, seen here with the French General Maxime Weygand as a passenger, taking the salute from the top hatch. The tank normally served with 5th Battalion, but was used to command larger formations such as brigades.

around the turret being eliminated), a Bishop's Mitre cupola added to the top, and the number of turret rollers again doubled. The work was not completed until about 1930, and in this form the tanks were reclassified Mark II*.

Starting in about 1931 some 50 of the Mark II* tanks were taken in hand for further conversion. An opening was cut in the back of the turret and a large armoured box fitted to house a Type MB wireless set. This modification, which involved about 50 tanks, brought them into line with the Mark IIA* and saw them redesignated as Mark II**. There were a few cases where tank commanders had the top of this box modified with short raised sides to create a tray for storing and laying out maps, although this would have been quite difficult to reach and very weather-dependent.

Modifications to individual tanks are few and far between. In 1926 Mark II T145, an Ordnance Factory tank, was adapted to carry bridging components, but since the War Office would only permit such work if it did not involve any fundamental alterations to the tank, the best that could be done was to fit the main bridging girders, folded in half, to brackets on each side of the tank from which the crew were expected to lift them off, unfold them and assemble them into a bridge. It was an impractical and short-lived experiment, and later T145 was seen as a conventional Mark II**. Another Ordnance Factory tank, T192, had a modified turret as a wireless command tank and was fitted with extra communication equipment. However it is not clear whether the turret was fixed or its gun was a dummy as some writers claim and pictures of it are quite rare. At least one tank, from 4th Battalion RTC, was photographed in battalion service running without a turret. But it is not clear whether this was a deliberate conversion into a reconnaissance or command tank or whether its turret had been temporarily removed for modification. Other modifications included the installation of an .80in (20mm) Elswick anti-tank gun in place of the 3-pdr, when that was considered the ideal weapon. This was tested at Shoeburyness on 29 September 1932. Later a 2-pdr gun was possibly fitted, when that was being adopted for tanks just before the war. At one stage T131, a Medium Mark II before it was converted into a Mark II** had some smoke-making equipment attached to the back for trial purposes, but it did not become a permanent fixture.

Most striking of all was T236, also built by the Ordnance Factory in 1926 and designated Tank for Radio and Wireless. This was a much more impressive modification with a large, box-like superstructure at the back and no turret at all. It was equipped as a mobile office and command post for senior officers and known variously as the Thunderbox, or Boxcar. Four more of these tanks were ordered to a



One of the four tanks sent to Australia displaying its unusual turret and here crossing some rough ground. In every other respect they were the same as their British counterparts. The Australians kept them going for quite a long time.

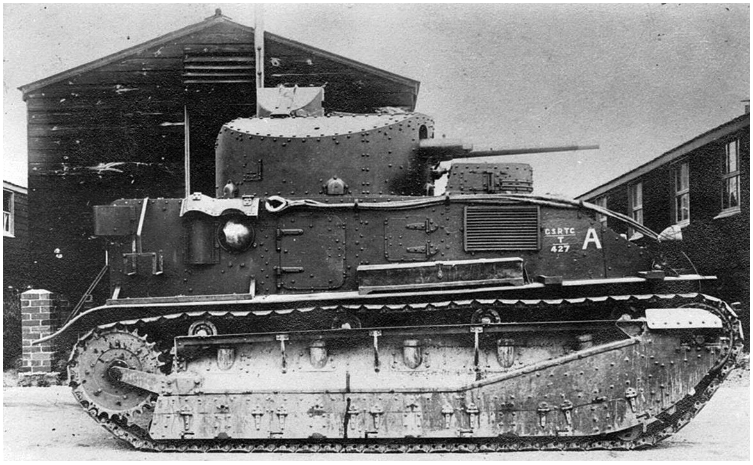
contract dated May 1927, but there is no evidence that they were ever built.

Four Mark II tanks from a Vickers contract dated 26 August 1926 and numbered T221 to T224 by the British system were completed for the Australian Army, arriving in Australia in September 1929. Both mechanically and in the form of their hulls the tanks were identical to those serving in Britain, except that additional ventilation was added on the left-hand side. However the turrets were completely different due to the fact that the Australian Army did not use the air-cooled Hotchkiss machine gun. The Australian tanks had a flat-topped turret, with no bevel at the back and only very small ones at each side. Instead provision was made for two additional Vickers water-cooled machine guns to fit into ball mountings in the vertical sides of the turret: one to the right of the main 3-pdr mounting at the front, the other at the rear on the left-hand side, in roughly the 2 o'clock and 5 o'clock positions respectively. Ball mountings were also provided in the hull sides for machine guns. The tanks were not finally disposed of until about 1942, but they were never subjected to the upgrades that British tanks were, nor were they fitted with turret cupolas or were wireless boxes fitted to the rear of the turrets. One tank has survived, and is in the Royal Australian Armoured Corps Museum at Puckapunyal, Victoria.

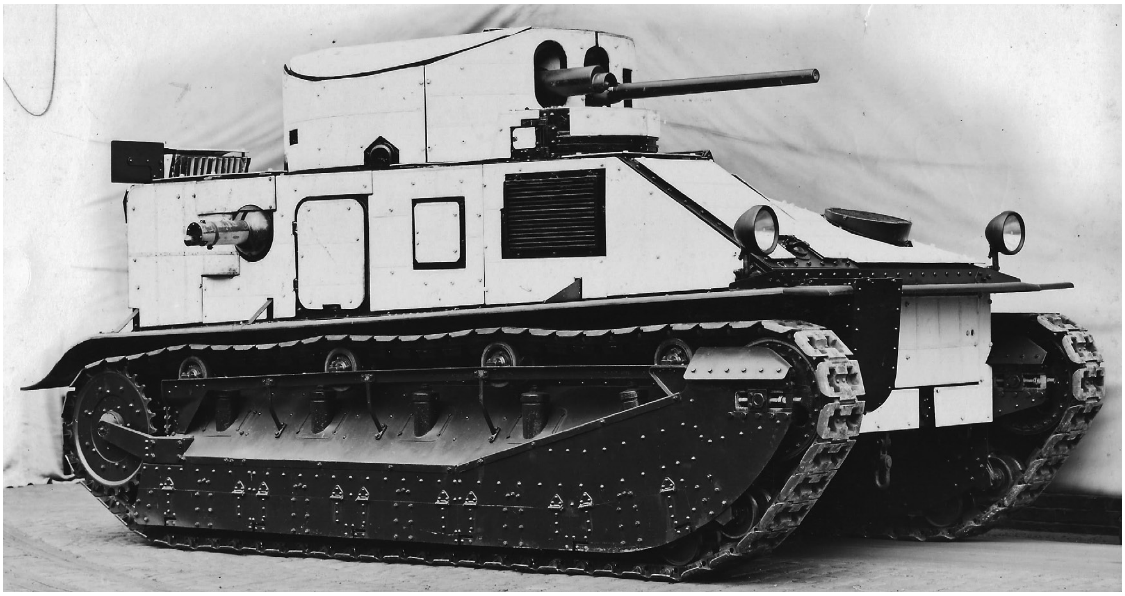
MEDIUM MARK IIA

These are most interesting tanks. Originally the ten Mark IIAs were destined for a new tank battalion to be raised in the Middle East, but ten tanks are nowhere near enough to complete a tank battalion. Despite suggestions that they should all be fitted with diesel engines, this was never done, and all ten of them were equipped with the old Armstrong-Siddeley 90hp air-cooled V8, which was already five or six years old. In the event not all of them went to the Middle East. A few (at least two) remained in Britain and in Egypt they seem to have served alongside ordinary Mark II tanks in what, after April 1 1933, became 6th Battalion Royal Tank Corps.

Given their limited numbers, the Mark IIA appears to have generated an inordinate amount of mythology. All previous sources claim that 20 were built, yet the handwritten ledgers in the Tank Museum only list ten; seven from the Ordnance Factory and three from Vickers, complete



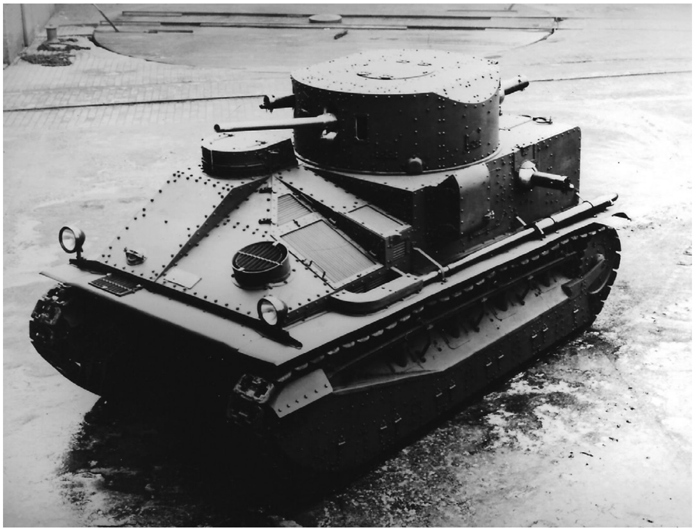
The Mark IIA is rarely seen except as a Mark IIA* with the turret bustle, but here is T427, photographed at Lulworth. CS on the side stands for Central Schools, not Close Support. Note the revised location of the return rollers.



A Mark IIA clad in panels of asbestos for service in Egypt, but for some reason missing its Bishop's Mitre turret cupola. The panels, which are said to have been edged in brass, give the tank a very clean appearance. How effective they were in reducing the internal heat is not clear.

with their individual WD numbers and road registration numbers, and all built to contracts dated 1928. These same sources also claim that the turret top was flat, reverting to the Mark I style. However a photograph of T427, taken at Lulworth, clearly shows a bevel on the back of the turret, like the Mark II, although why this was done might be questioned, since the light machine guns used in the anti-aircraft role seem to have been abandoned around this time. Reference is also made to suspension modifications, but this appears to affect only the leading and trailing suspension units where a new method of securing the rollers was adopted. The most characteristic and visual difference in the Mark IIA seems to have been the method of mounting the track return rollers. There were four of these on each side and their spindles, instead of passing through the support beam as hitherto, are now mounted on top, in special brackets, making them more obvious. The door on the left side of the hull appears to have been raised a little bit to clear the exhaust pipe which now runs straight back, rather than dipping in the middle to clear the lower edge of the door as before. Inside the tank appears to be the same as earlier models, with the same engine and transmission, except that a clutch stop was fitted, perhaps to make gear changing easier. The addition of a box-like extension to the turret rear, to contain a radio, brought them up to Mark IIA* and seems to have involved all ten of them, and extra rollers had to be fitted to take the weight, six instead of the original three.

For some reason the two tanks retained in Britain and at least two in the Middle East were later adapted to mount the 3.7in close-support weapon instead of the 3-pdr, and one tank photographed in Egypt appears to have slots cut into the armour at the front of the hull, presumably to improve the air flow around the engine. Tanks in Egypt also seem to have been covered in panels of woven asbestos and one was photographed without its Bishop's Mitre cupola, but that may only have been temporary. During World War II one tank in the Middle East was photographed guarding a prisoner-of-war cage, while two are said to have been buried, up to their turrets, as part of the fixed defences at Mersah Matruh. Later on the Australians apparently dug these two tanks out. One was returned to working order while the other, apparently too far gone to warrant repair, was mounted in the back of a lorry and driven around. Later still both tanks fell into German hands, but, besides being objects of curiosity, don't appear to have been used. One Mark IIA* ended up without its gun in the collection at the Ordnance Museum at Aberdeen Proving Ground in Maryland, but it has since been removed to Fort Benning, Georgia, the only known survivor of the type. Another was found buried in Ashdown Forest in Sussex, but having been recovered and shipped to the Tank Museum in 1989 was deemed too far gone to be worth restoring, and subsequently scrapped.



An 'English Workman' version of the Mark IIA built for Russia. The turret is similar to the Australian one, with much smaller side bevels and Vickers-type machine guns instead of Hotchkiss weapons, but not co-axially mounted. This is believed to be the only tank fitted with a 3-pdr gun. The other 14 mounted Russian 45mm guns.

THE RUSSIAN TANKS

In 1929 a Soviet purchasing commission came to England as an International tour visiting armaments producers. The party went to Vickers-Armstrongs – as it had become – and among other things decided to order 15 Medium Mark IIA tanks, suitably modified. A year later, with political matters settled and finance approved, production could go ahead. The order did not just involve 15 Vickers medium tanks, but other Vickers products as well, such as Carden-Loyd carriers and some light amphibious tanks.

The Mediums (said to have been named 'English Workman' by the Russians) had Mark IIA hulls surmounted by turrets similar to those fitted to the Australian tanks – that is to say that they had shallow side bevels and no bevel at the back at all. Since the Hotchkiss machine gun was not used in Russia the tanks had two mountings in the turret for water-cooled machine guns; in place of Vickers guns the Russian mounted Maxims. These guns were arranged like those in the Australian turret and there was no co-axial mounting at all, despite the fact a co-axial gun was provided in the Mark IIA. Likewise no cupola was fitted on the turret, just a flush-fitting, two-piece top hatch, although regular Mark IIA tanks were provided with a Bishop's Mitre cupola. The tank carried machine guns in each side of the hull, as did those supplied to Australia. Since the medium tank was long past its prime it is not surprising that they were found to be not a lot of use to the Russians. It has been suggested that only the first tank, the one photographed at the Vickers-Armstrong factory, was provided with any weapons, the rest being shipped without any guns at all. In Russia they appear to have been fitted with their 45mm weapon and as such took part in one parade through Red Square. Later they appear to have been shipped down to Kazan, in the Urals, where the Russians had a Tank Training School, which was also used by Nazi Germany. It has been suggested that this was done to impress upon the Germans how backward the Russians were in tank development when the opposite was actually true. Later some derelict medium tanks, without their guns, were discovered in Finland at the time of the Russo-Finnish war, but how they got there and what they were doing there is not recorded.

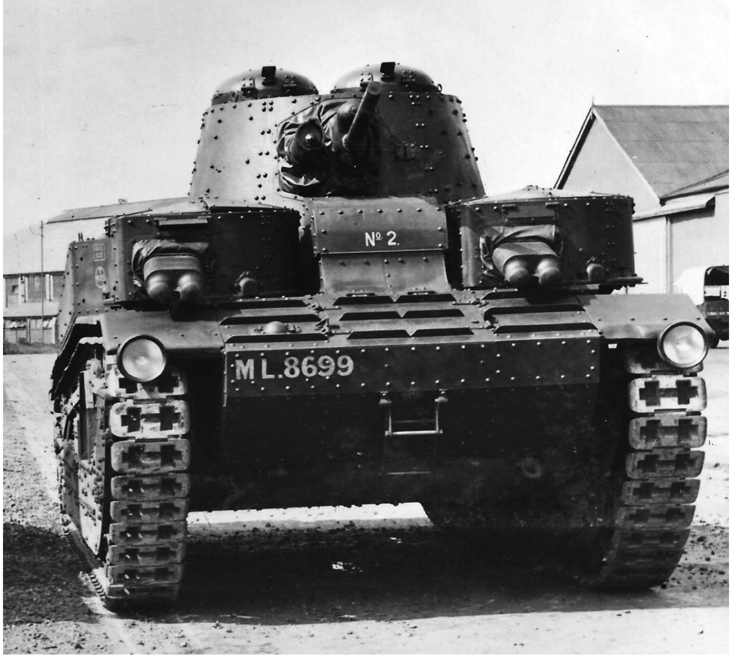
THE A6 SERIES

For the second time (the A1E1 Independent was the first) the Royal Tank Corps Centre was asked to submit its ideas on a new tank to the War Office for onward transmission to Vickers (which was not to become Vickers-Armstrongs for another year). The Royal Tank Corps Centre wanted two auxiliary machine-gun turrets and the main armament was required to penetrate hostile tank armour at 1,000 yards (which was possible with the 3-pdr, and appears to be the first time that weapon performance was ever mentioned). The new tank should weigh no more than 15½ tons and be transportable by rail; its radius of action should be equal in terms of petrol and lubricating oil consumption; and every effort should be made to make the tank as quiet as possible.

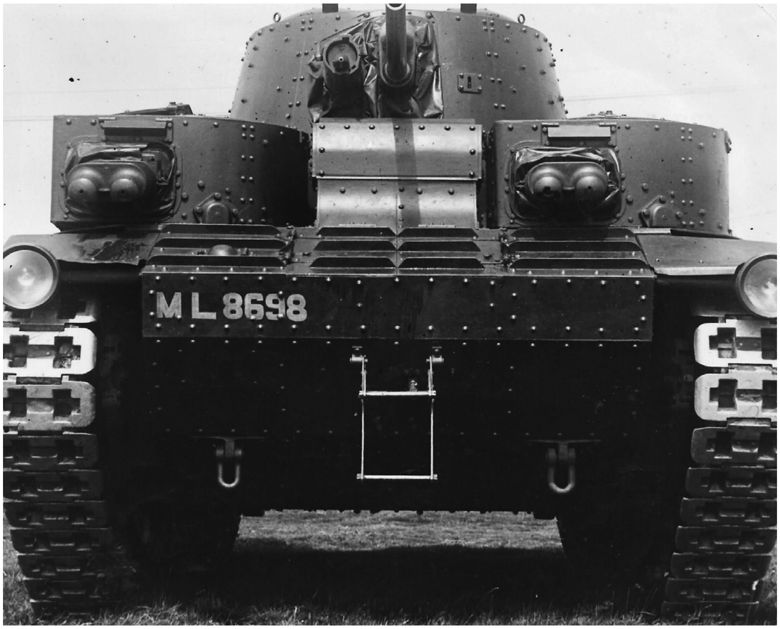
The War Office added a preference for a rear-engine layout and wanted better steering arrangements than in the Medium Mark II series. It also emphasized the weight limit of 15½ tons to enable the tank to use existing military bridging. These requirements were forwarded to Vickers, but otherwise the Vickers designers were left to get on with it, which they did remarkably quickly.

Three A6 series tanks were built – T404, T405 and, slightly later, T732. To confuse the issue, however, T404 was issued General Staff number A6E2 and went to MWEE first, while T405 was A6E1 and went to MWEE about two months later. T732 was A6E3 and did not go to MWEE for more than a year. Each tank will be discussed separately, since they all underwent different modifications, but first a general point should be made about the design.

Vickers designed the main turret with full 360-degree traverse and fitted the turret with a pair of lookout cupolas (at least on the first two). One cupola was for the tank commander, and the other was for an observer, who was otherwise the loader. His job as observer was to watch the fall of shot and keep an eye on the battlefield. Vickers actually wanted to incorporate a third machine-gun turret behind the main one, which was to be capable of high-angle fire for anti-aircraft use, but within the weight limits this could only be provided if no side skirts were fitted over the suspension, of which the War Office would not hear. Even so all three tanks finished up overweight and despite being known as '16-tonners', tipped the scales at even more than that. They were all to be powered by a 180hp-rated larger-bore version of the Armstrong-Siddeley air-cooled V8 engine, which seems to have performed reasonably well. Although the first two had different gearboxes, both had a Wilson epicyclic steering system.



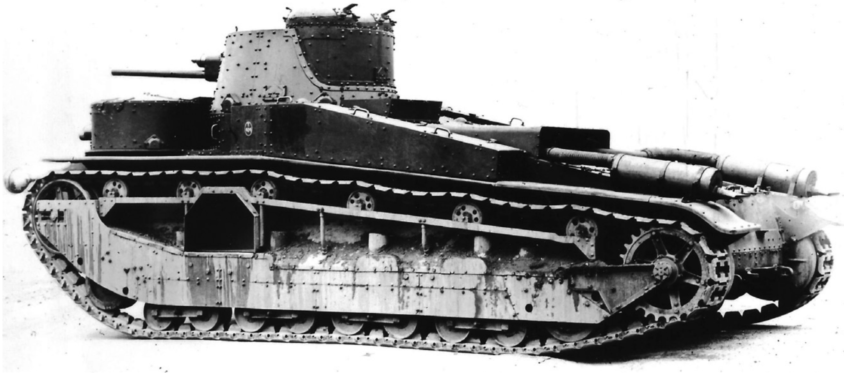
A6E1, the first of the '16-tonners'. Notice that there are two machine guns in each of the subsidiary turrets, which proved a bit too ambitious in the end. The driver sits between these two turrets, but how he could see out when closed down is not obvious.



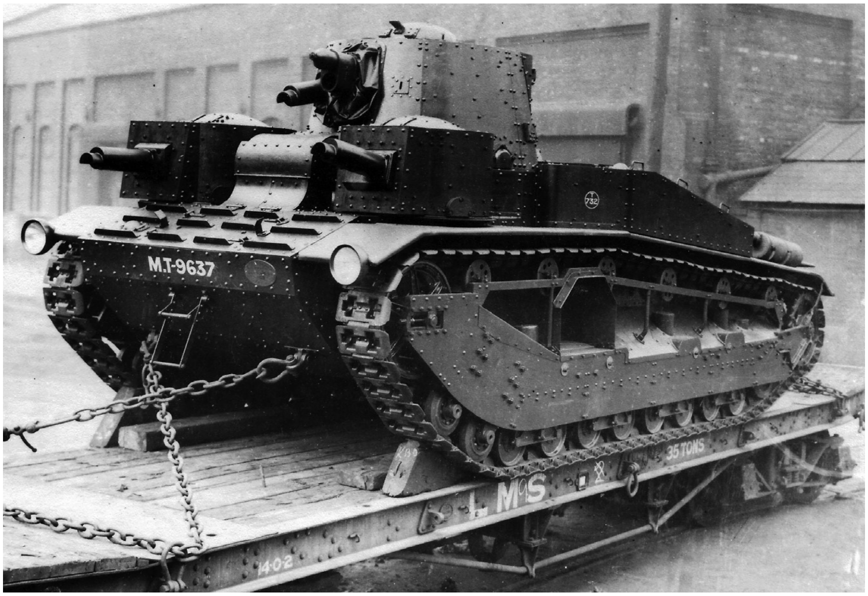
Looking, not surprisingly, very similar, A6E2 has the same arrangement. Fitting anti-splash rails across the front is a very modern approach, although they would also help the driver's feet to grip when he climbed aboard, which is also what the front step is for.

The first tank, T404 (A6E2), came to MWEE from Vickers, Sheffield on 16 May 1928. It was powered throughout its service career by an Armstrong-Siddeley air-cooled V8 engine rated at 180hp, but which developed 200bhp. It drove through an Armstrong-Siddeley four-speed crash gearbox linked to a two-speed reduction box. Mild steel in lieu of armour was of a maximum of 14mm, but the all-up weight of the tank was 16 tons 12 cwt. Each of the auxiliary machine-gun turrets contained a pair of Vickers water-cooled machine guns; a third such weapon was mounted co-axially with the main armament, the quick-firing 47mm Mark 2 gun normally referred to as a 3-pdr. The crew comprised six men: a driver, two machine gunners, a main turret gunner, the loader/observer and the tank commander. The tank could cross a 9ft-wide trench and had a top speed of 26mph. Although it never seems to have been modified, it lasted quite a long time, being recorded as being issued to Field Stores on 20 December 1938. Each tank carried 120 gallons of petrol, mostly in tanks located on the trackguards, but these proved prone to rust and had to be replaced with tanks made from stainless steel, which also proved expensive.

The second tank to arrive at MWEE was T405 (A6E1). It came from Vickers, Sheffield on 4 July 1928 and resembled A6E2 in all respects except that it had a Winterthur oil-operated, synchromesh gearbox instead of the Armstrong-Siddeley crash type. This gearbox, which was also known as an SLM type (Switzerische Lokomotiv und Maschinenfabrik) was a four-speed type normally installed in diesel locomotives, which needed no clutch. In T405 it came with a second ratio, probably an auxiliary gearbox, but in this form the tank weighed 17 tons 5 cwt, which may have been due to the weight of the gearbox. It was the same in virtually every other



T404 (A6E2) seen from the rear. Notice the two turret cupolas, one for the commander and the other for the observer. Also note the relatively large area allocated for the engine and transmission. Two exhaust pipes and silencers were provided for the V8 engine.



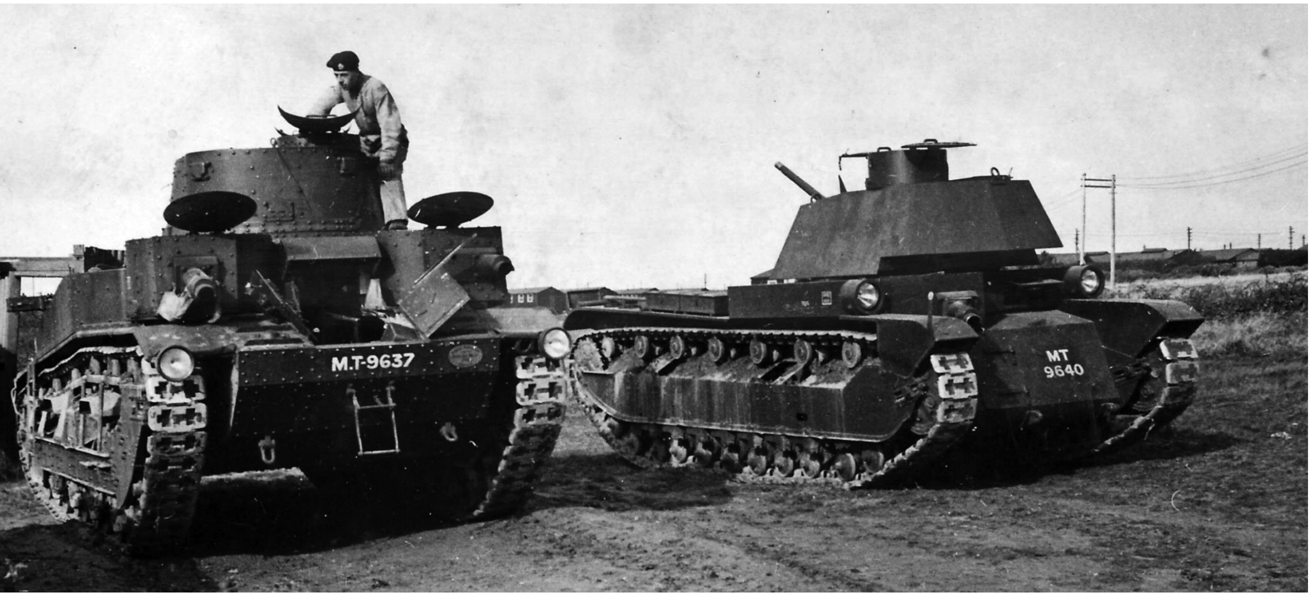
A6E3, the third in the A6 series. It was designed to be armed with single machine guns, although none are mounted here. The London, Midland and Scottish Railway is not taking any chances. It has provide a 35-ton payload bogie bolster wagon for one nominally 16-ton tank.

respect to its predecessor, but is recorded as having a top speed of 27mph, reduced to 15mph across country. A minimum armour thickness is now given as 6mm, which may be the same for A6E2. On 16 March 1933 the tank went to Woolwich to have a diesel engine fitted. It was a Ricardo type S/180, a six-cylinder unit rated at 180bhp. These engines were normally water-cooled (although that is not recorded), and even though we know that the SLM gearbox was cut back to a three-speed unit, we do not know if this was a new gearbox or the original unit with one gear blanked off. In this form the tank is recorded as weighing 19 tons 4 cwt, but it could well be that by this time it had been decided to use the tanks for automotive trials and avoid the gunnery aspect, since that had not proved to be any improvement on the earlier types.

Gunnery trials at Lulworth showed that the mounting of the main armament was not even as good as in the Medium Mark II and improving it would involve an expensive redesign; at the same time the dual Vickers machine-gun mount in each of the sub-turrets was found to be unworkable, so it was decided to reduce these to a single gun in each turret, but not until the third A6 series tank was completed. So, for the present the A6 tanks were regarded as automotive test rigs, which might have explained the installation of the Ricardo diesel in A6E1. Gunnery, for the moment, would become a secondary consideration.

A6E1 went back to Woolwich in November 1937 to have the diesel engine removed and presumably replaced by the Armstrong-Siddeley petrol unit, but both tanks had remained in service with either engine for quite a long time. In the end A6E1 joined A6E2 at Field Stores on 20 December 1938 when both were presumably scrapped.

The third of the A6 series, T732 (A6E3), was a most interesting tank. It was delivered to MWEE on 20 October 1929 from Vickers-Armstrongs Ltd – the new name for the company, but from their old Sheffield factory. In many respects it was similar to the earlier tanks and differed mostly in the transmission and fighting arrangements. The transmission now saw the removal of the gearbox and instead a full Wilson transmission was installed. This consisted of a simple dog clutch at the central transfer box, which gave the option of forward or reverse travel, and then a six-speed epicyclic gearbox on each half shaft with a brake at its outboard end. This



A6E3 photographed with A7E2, both with their turrets reversed. Notice that A6E3 only mounts a single machine gun in each subsidiary turret. Although it's not very clear, it looks as if A6E3 is fitted with the Horstmann suspension.

gave the driver the choice of six speeds in either direction along with a system of geared steering by selecting different speeds in each box. If the driver needed to change gear during a turn then the ratio of difference between the two boxes was retained. The auxiliary machine-gun turrets at the front each contained a single water-cooled Vickers machine gun, and the turrets themselves had been modelled on the type fitted to the Independent tank A1E1. A single cupola was fitted to the rear of the turret, indicating that the idea of an independent observer working alongside the commander had been done away with. The sixth crew member was retained, although presumably reverting to his role as loader only. Armour remained at 14mm maximum and the weight went down to 16 tons 9 cwt. Meanwhile top speed had gone up to 30mph.

All along, however, it was the Vickers box-bogie suspension that had proved unsatisfactory and resulted in the unfortunate gunnery trials at Lulworth, where the tank had been found to be a poor gun platform. Various attempts had been tried, by strengthening the springs and adding shock absorbers, but the problem remained. Then in 1934, Sir John Carden of Vickers-Armstrongs, in conjunction with Mr Horstmann of Slow Motion Suspensions Ltd, came up with a new design that was fitted to A6E3 in 1935, the year that Carden was killed. Although the new suspension relied on Vickers suspension units at each end, the main section in the middle was pure Horstmann, with dual roller bogies, mounted in pairs under horizontal coil springs linked to double-acting shock absorbers, controlled by the driver. It gave a much better ride and made the tank a much more stable gun platform, as further trials at Lulworth confirmed. But it really needed to be tested at speed, which required a much more powerful engine.

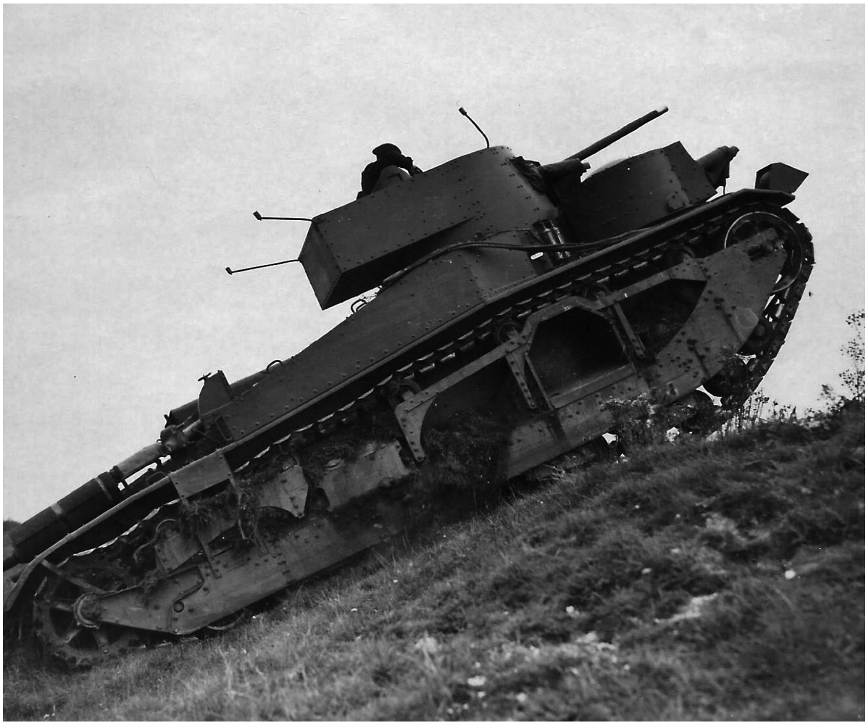
The choice fell upon the Thornycroft RY/12, a marine engine rated at 500hp and presumably water-cooled. This was installed in October 1934, then the tank went to Vickers-Armstrongs in Chertsey, Surrey, to have the suspension fitted for two months in 1935, beginning in February. The higher speeds achieved with the Thornycroft engine were never recorded, although the new suspensions seems to have stood up well to the work. The engine was removed in October 1938 and it, or one of the same type, was selected for the equally abortive A14 heavy cruiser tank completed in the summer of 1939.

Subsequently the hull of A6E3 was reported as being used for anti-tank mine trials from October 1939, after which nothing more is heard of it.

THE MEDIUM MARK III

Only three of these tanks were ever built: two by the Royal Ordnance Factory (T870 and T871, to a contract dated September 1930) and one by Vickers-Armstrongs (T907, to a contract dated February 1931). All three tanks were delivered in 1933, while the experiments with the A6 series were still ongoing, so no advantage could be taken of them. As a result they were mechanically identical to the A6 tanks as built, with the air-cooled Armstrong-Siddeley 180hp V8 engine, the Armstrong-Siddeley four-speed crash gearbox and the Vickers box-bogie suspension. Such differences as there were involved the fighting arrangements. The two machine-gun turrets, each mounting a single weapon, were moved slightly further forwards and, although the main armament was the same it was housed in a new design of turret. This had sloping sides, a flat roof and a large bustle, a box-like extension at the rear of the turret which housed the wireless set. It was surmounted by a rotating commander's cupola of the Bishop's Mitre pattern and the entire turret crew were carried around on seats or a pedestal suspended from the turret as it rotated – by geared manual control of course, powered turret rotation not having been invented at that time.

Trials at Lulworth revealed that as gun platforms the tanks were not an improvement, and the box-bogie suspension bottomed heavily on rough going at any kind of speed, making the gunner's job impossible; in addition, being almost unique,

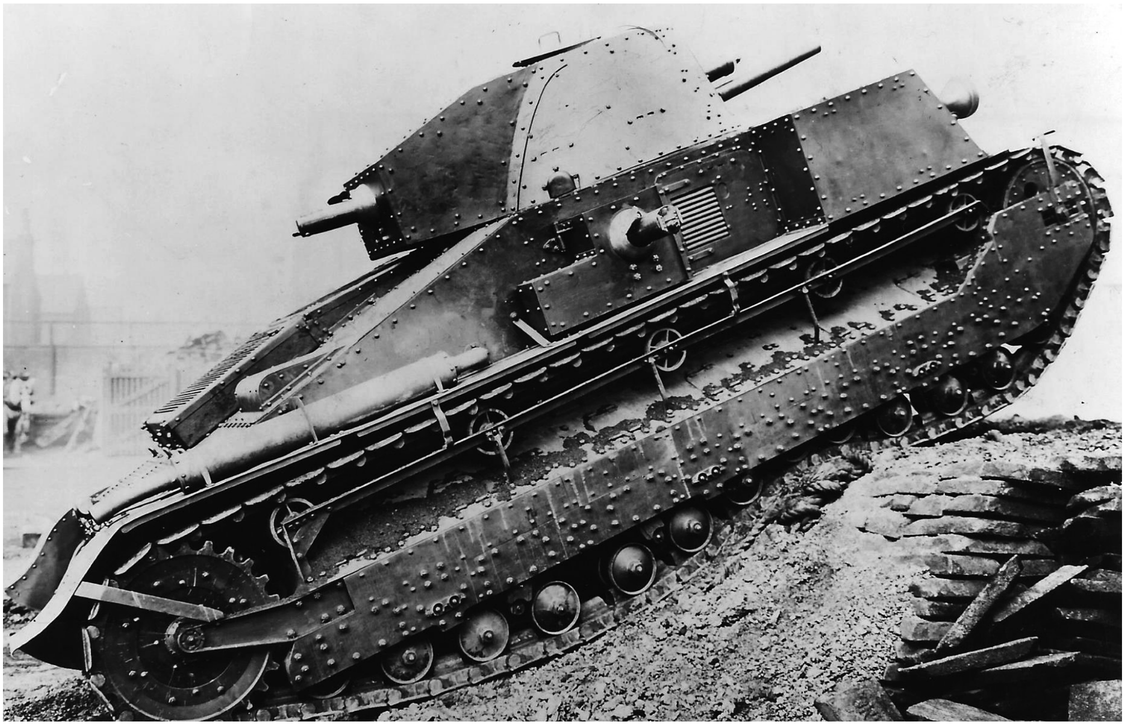


A Medium Mark III serving as a Command Tank with 1st Tank Brigade in 1934. Notice the longer turret, with wireless bustle at the back and the Bishop's Mitre cupola. The tank also seems to be fitted with shaded headlamps at the front.

they could not be used with ordinary fighting formations. As a result the three tanks appear to have been used as command and control vehicles during Tank Brigade exercises, carrying senior officers and additional wireless equipment that usually required a rail-type aerial to be fixed around the turret. One of the Royal Ordnance tanks, T871, caught fire near Swindon in September 1934 and blew up; the crew escaped but the tank was considered a constructive total loss and was handed over to the Royal Army Ordnance Corps as a recovery hulk. Of the two remaining, although the Vickers tank went to MWEE in 1933 and the surviving Royal Ordnance tank in 1935, nothing more is known about them. They were expensive tanks, probably too expensive for a peacetime budget, and so the War Office decided to look elsewhere for the ideal medium tank.

VICKERS AND VICKERS-ARMSTRONGS COMMERCIAL MEDIUM TANKS

Vickers' first venture into the world of competitive commercial tank design was not terribly successful. For a start the company was inhibited by not being permitted to include any feature that was inspired by the British Government. Although it should have given them freedom to use alternatives, it appears to have restricted them to some extent and certainly two of their earliest designs, the Mediums Mark A and B, which never got beyond the drawing-board stage, seem to have been relatively unimaginative. The Medium Mark C was a lot better however, and so much so that a party from the War Office made a special trip to Sheffield to inspect it. Only one was ever built and it was sold to Japan. The tank weighed 11½ tons and was powered by a Sunbeam Amazon six-cylinder engine, water-cooled and rated at 185hp. The



The Vickers Medium Mark C tank. It was powered by a six-cylinder Sunbeam Amazon water-cooled engine and was armed with a 6-pdr gun. The driver sat in a partly projecting housing at the front, with a door alongside him.

engine drove forwards, but then drive was transferred immediately across to the clutch and gearbox, situated alongside the engine, and thence through a transfer box to the steering epicyclics and from them to the rear-mounted drive sprockets. The radiator and fan, on the other side of the tank, seem to have taken up a lot of space, but there are no accounts of cooling problems, so it may have been justified.

The suspension relied on numerous small rollers, but these were grouped together as compensating bogies by a system of springs and levers, which was later adopted for one of the A7 Medium tanks and subsequently the A12 Matilda. Although Vickers was counting on a top speed of 18mph, it seems that 11mph was the most it could ever get the Medium Mark C to do. The tank also proved awkward to steer, perhaps due to the length of track in contact with the ground. Armour was limited to 6.5mm, which probably accounts for the light overall weight, although it seems unduly thin for a medium tank. The armament layout includes a 6-pdr (57mm) gun in a turret with all-round traverse, although there was no co-axial machine gun, and indeed the only other turret-mounted weapon, a Vickers water-cooled .303, was mounted at the back of the turret in an ugly-looking bustle. The three other machine guns, also Vickers water-cooled weapons, were mounted in the hull, one on each side and another in the front, to the left of the driver.

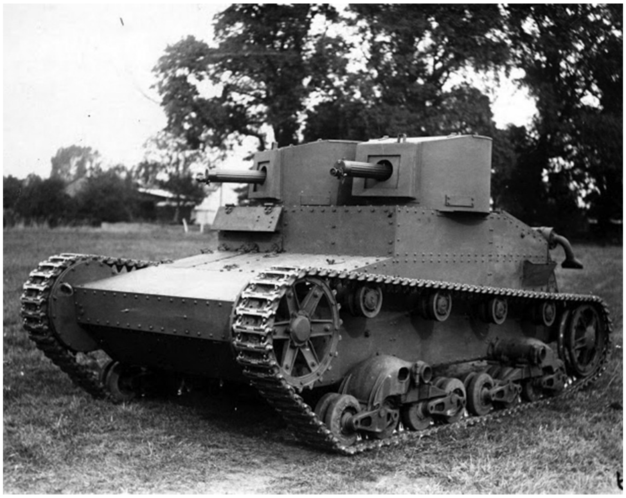
The crew is said to have numbered five, and they must have had their work cut out if all the guns were to be manned. The driver was located in the centre at the front, but with an extension on the front of the tank to accommodate his feet and the controls, a most peculiar feature. To the driver's right was a door, described as a lookout door, but in the front plate of the tank, where no door should be allowed.

The tank went to Japan, and during trials in March 1927 the engine backfired and set the tank alight, severely burning one of the Vickers engineers who went out with it. This accident is said to have led the Japanese to develop air-cooled diesel engines for most of their later tanks, although the Medium Tank, Type 89, the design of which seems to have been based on the Medium C, used a Daimler six-cylinder petrol engine.

Shortly afterwards Vickers built a second tank, which it styled the Medium D. It appears to be identical to the Medium C except that it sported a low-profile turret cupola. It was sold to the army of the Irish Free State. It is not altogether clear what the Irish wanted such a big tank for, except for instructional purposes, but they retained it until 1940 when it was scrapped. Its 57mm gun has been preserved.

THE VICKERS-ARMSTRONGS SIX-TONNER

Known, logically enough, as the Medium Tank Mark E, the so-called six-tonner, was a dramatic departure, in both size and design, from what had hitherto been conceived as a typical medium tank. The prototype, which appeared in 1928, was a bit shorter, narrower and much smaller than a traditional medium tank. It carried two turrets side-by-side, each armed with a single machine gun, and it could be operated by a crew of three. The engine, believed to be a water-cooled Dorman unit rated at 80hp, was located in the back, but unusually for a British tank, drove drive sprockets at the front through a five-speed gearbox and transfer box to simple clutch and brake steering units at each end of the drive shaft. The suspension consisted of two groups of rubber-tyred bogies at each side. Each bogie was held on a cross tube, using leaf springs, and rollers arranged in moveable pairs. It appears to have been this suspension that condemned the tank in the eyes of British experts – that and probably its size.

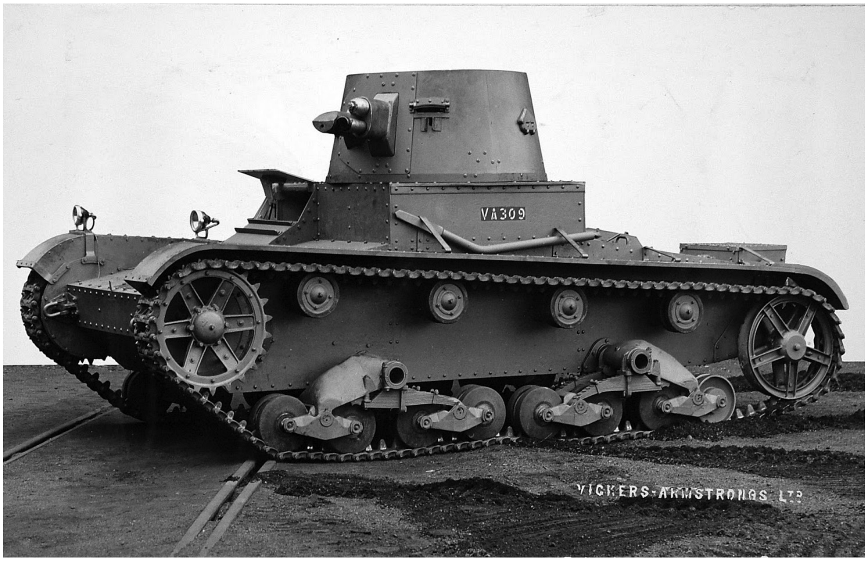


The prototype 'six-tonner' powered, we believe, by a Dorman water-cooled engine. It mounts twin machine-gun turrets, like the Type A. Notice that the drive sprockets are at the front, but in particular study the suspension and the tracks which appear to be entirely new design features.

The drive shaft, passing through the tank from back to front, is said to be one reason why a twin-turreted layout was chosen in the first place. The tank had armour 13mm thick, which complied with other, larger, medium tanks and had a top speed of 22mph, which was a lot faster than many.

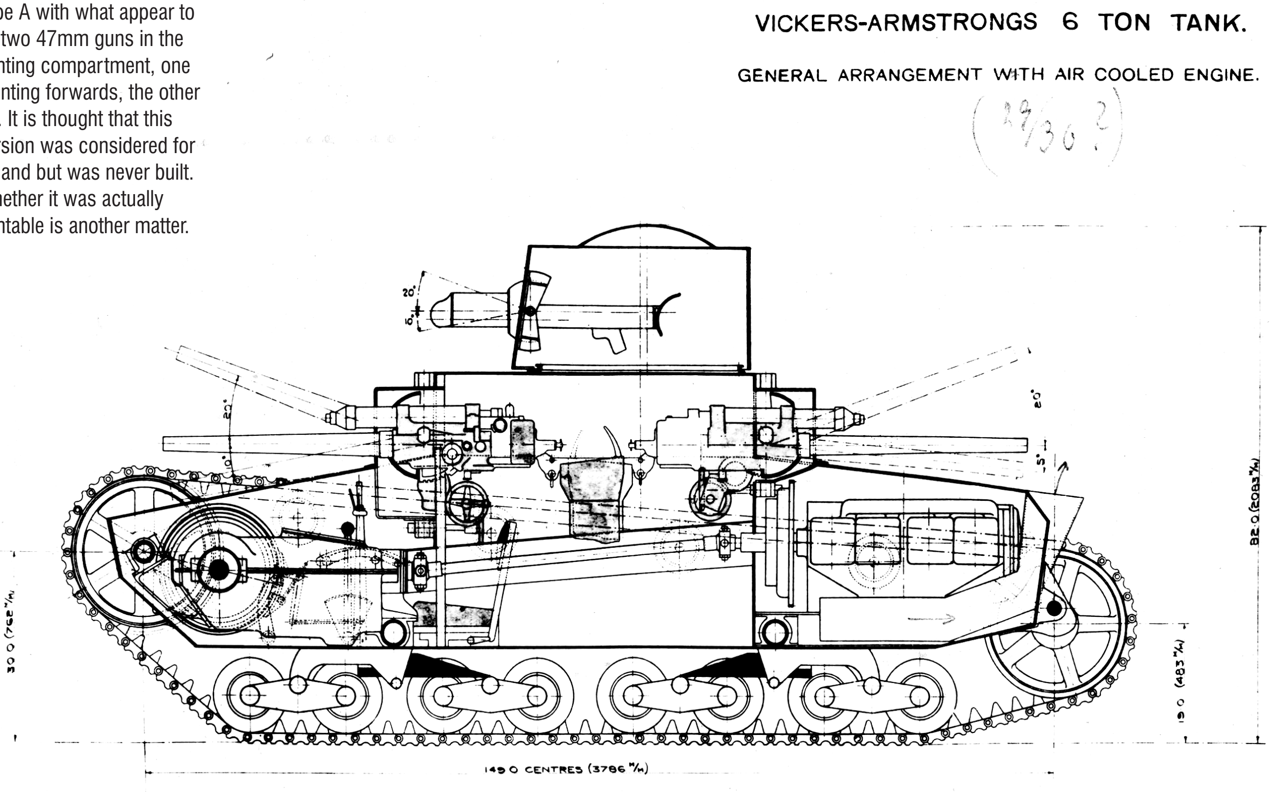
Production versions of the tank were fitted with an air-cooled four-cylinder Armstrong-Siddeley engine with 4¾in-x-5¾in cylinders, rated at 80hp. Mounted on its side meant that the engine compartment could be a lot lower, reducing the overall bulkiness of the tank even more. Latterly the Type B version of the six-tonner was introduced, which carried one large turret armed with a short 47mm gun and a Vickers machine gun; the crew is still given as three, although four seems to be more workable. Over time the twin-turreted version, the Type A, seems to have lost favour to the other version and eventually appears to have faded from the scene. Vickers-Armstrongs announced that it was prepared to accommodate customers who might want to use different machine guns or have a wireless set fitted of whatever type they preferred.

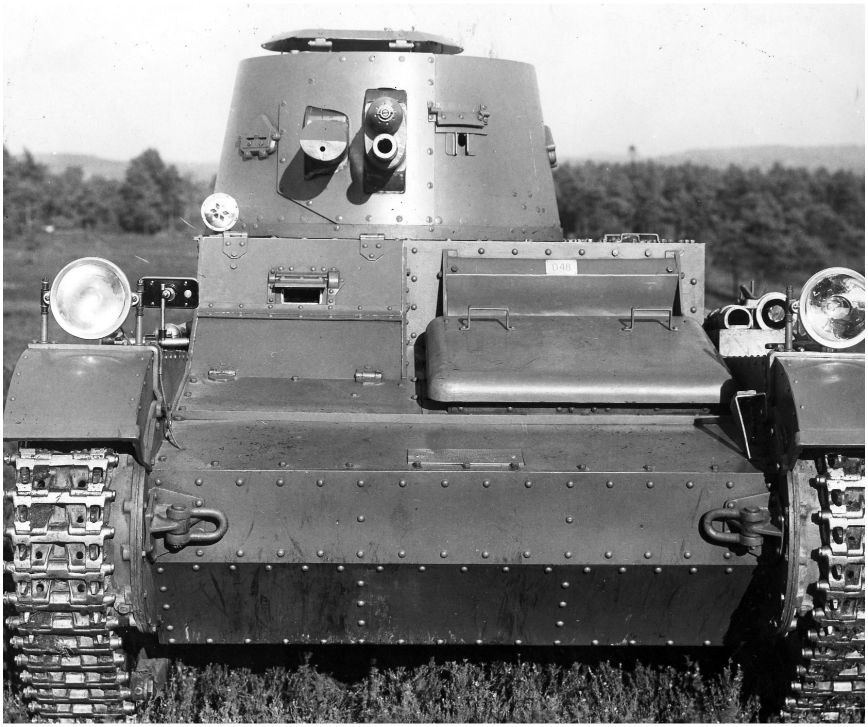
Although it failed to interest the British War Office the six-tonner was a great export success, with the first orders coming in 1930. Russia ordered 15 of the Type A variant, which had a box-like extension added to the front of each turret for the air-cooled 7.62mm DT machine-gun. These tanks were built in the new Vickers-Armstrongs factory at Elswick, Newcastle-upon-Tyne, alongside the medium tanks. Russia decided to build its own version under the designation TMM, but it failed to come up to standard, so a licence-built version, known as the T-26, was built instead. It appeared in large numbers, in both double- and single-turreted versions, the latter mounting a 45mm dual-purpose gun. Six-ton tanks were also supplied to Greece



A Vickers-Armstrongs posed photograph of a Mark E, Type B, one of the two tanks exported to Greece. Notice the mounting for the short 47mm gun and the Vickers machine gun alongside it. It was a simple and rather basic tank, but seems to have been just what customers wanted.

A proposed design for the Type A with what appear to be two 47mm guns in the fighting compartment, one pointing forwards, the other aft. It is thought that this version was considered for Poland but was never built. Whether it was actually fightable is another matter.


VICKERS-ARMSTRONGS 6 TON TANK.
GENERAL ARRANGEMENT WITH AIR COOLED ENGINE.
(29/30 ?)
20°
10°
20°
10°
20°
5°
82.0 (2083 m/m)
30.0 (762 m/m)
19.0 (483 m/m)
149.0 CENTRES (3786 m/m)



Vickers-Armstrongs Mark F fitted with a water-cooled Rolls-Royce engine. It is provided with an air inlet louvre on the glacis plate. Notice how the turret has been moved as far over as possible. There was some interest from Belgium, but with war imminent, building tanks for overseas customers was curtailed for the duration of World War II.

(one twin- and one single-turret tank each), Finland (one single-turret), Poland (22 twin-turrets, 18 single-turrets), Bulgaria (eight single-turrets), Siam (Thailand) (ten single-turrets), China (20 single-turrets, four with wireless) and even Bolivia (one single-turret and two twin-turrets). Sample tanks were sent to Portugal and the United States for evaluation. A twin-turreted tank was tested by being paddled by raft across the river Thames and one, possibly the same one, was demonstrated fitted with Straussler trench-crossing legs fore and aft.

If Vickers had a fault it was in trying to squeeze too much out of an old design with only limited improvement. Such an instance may be the case with the Vickers-Armstrongs Mark F which appeared in 1934. To all outward appearances it was a variant of the single turreted six-tonner, and is often mistaken as such from photographs. Since the old Armstrong-Siddeley engine was getting a bit long in the tooth, it was replaced by a water-cooled, six-cylinder, Rolls-Royce 20/25hp engine which, on account of its size had to go upright in the left side of an extended central compartment, tilted slightly forwards to meet up with the transmission. There was a cowled air louvre on the front of the hull and a radiator in the back. The rear section of the hull was not only shorter, it was much more steeply inclined, while the turret was fitted as far over to the right as possible – indeed to the point that part of the turret ring was projecting through the side of the hull in order to separate the crew from the engine. The Mark F was tested by the Belgian Army, but no orders were forthcoming and with another war imminent nothing more was heard of it. In 1938 a further order for the Mark E was received from Siam, although it seems to have specified the Armstrong-Siddeley engine. As a result Vickers-Armstrongs appears to have used the Mark F hull, but with the turret shifted across almost to the other side. Four of these, still undelivered in 1940, were taken into British Army service as training machines and one of them survives in the Tank Museum collection at Bovington.

CHAPTER 9

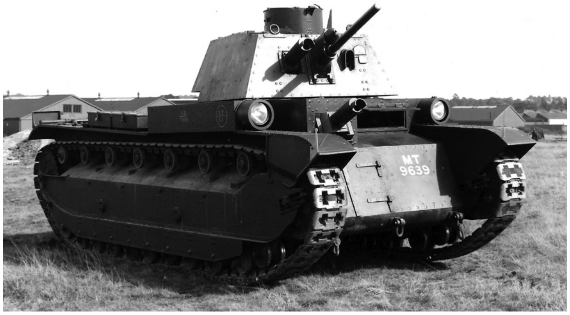
1930s TANK DEVELOPMENTS

THE COUNTDOWN TO WAR

Although A7E1 and A7E2 were designed in 1928 they were not delivered to MWEE until 1932, and therefore fall into the post-1930 category. These tanks were ordered as 10-ton medium tanks but were found to weigh over 14 tons unladen when they were delivered. They were designed by the department of the Superintendent of Design, and built at the Woolwich Ordnance Factory. The object was to produce a tank that was longer, lower and faster than the rival A6 series and, in particular, to be somewhat cheaper. In fact in terms of overall dimensions there was not a lot of difference: the hull was definitely longer and flatter than the A6 and the rectangular turret an improvement, but atop the turret was a large, independently rotating commander's cupola, so even the overall height was little different. Armour protection was also about the same, while the engine in both tanks was a 120hp air-cooled Armstrong-Siddeley V8, which seems to have been notoriously unreliable and did not produce any overall improvement to the speed.

If there was any saving in costs it was probably with the hull machine-gun mountings. Gone were the two front turrets, and instead only one gun was fitted, in a gimbal mounting at the front on the right to give the widest possible arc of fire; however, the mounting was fitted into the front of a box which effectively obscured the driver's view to his right. In fact the driver, tucked away on the left side of the tank, was in an unenviable location and his most direct escape route, which he shared with the hull machine gunner, was through a two-piece hatch in the front plate of the tank, hardly the safest way to go. There were no hatches in the side of the tank at all.

In terms of transmission and suspension both tanks were different for comparative purposes. A7E1 had a conventional Armstrong-Siddeley four-speed sliding gearbox and an emergency low ratio, with a Wilson epicyclic steering system. Its suspension consisted of sets of four rollers, on short trailing arms, linked by overhead leaf springs; there were two of these on each side and, besides giving a sprung ride with a limited amount of deflection, they provided what was called a compensated system, so that the effect of crossing an obstacle was reduced by internal movement of the bogies.



A7E1, the first of the so-called 10.5-ton Medium tanks. Notice how the driver no longer has a prominent position, but the front is dominated by the machine-gun housing and the ridiculous double door beneath it. However, the design of the turret set a pattern for other tanks.

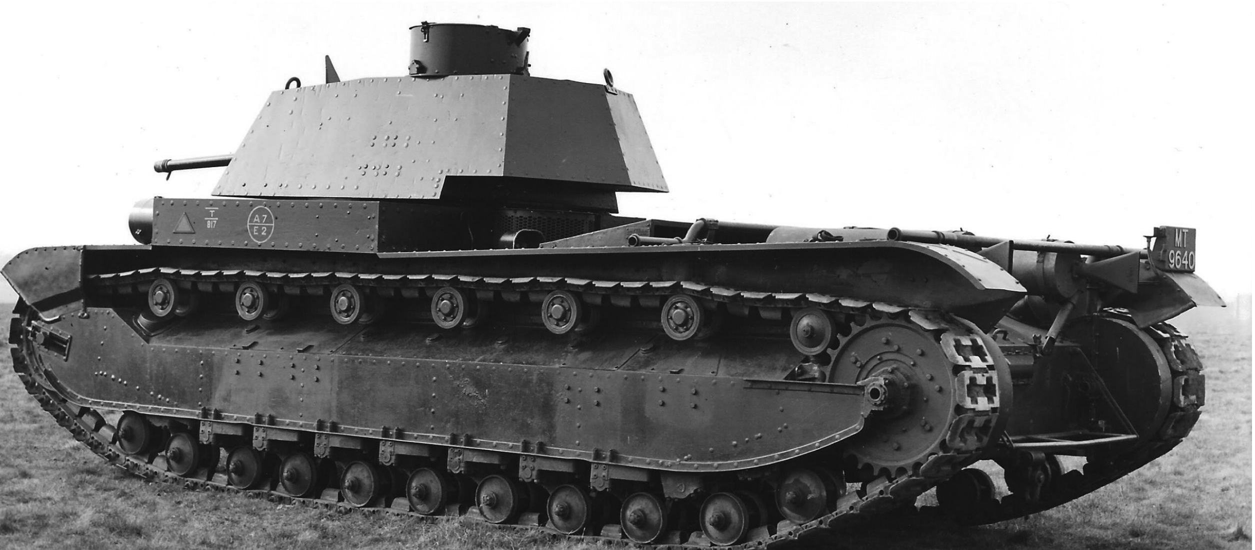
This gave the tank a top speed of 27mph. Horstmann, the inventive proprietor of Slow Motion Suspension Ltd of Bath, had actually suggested something similar which involved rollers on cranked arms attached to lateral rods that provided springing by twisting, which sounds like a very early system of torsion bar suspension for tanks, but this was not adopted.

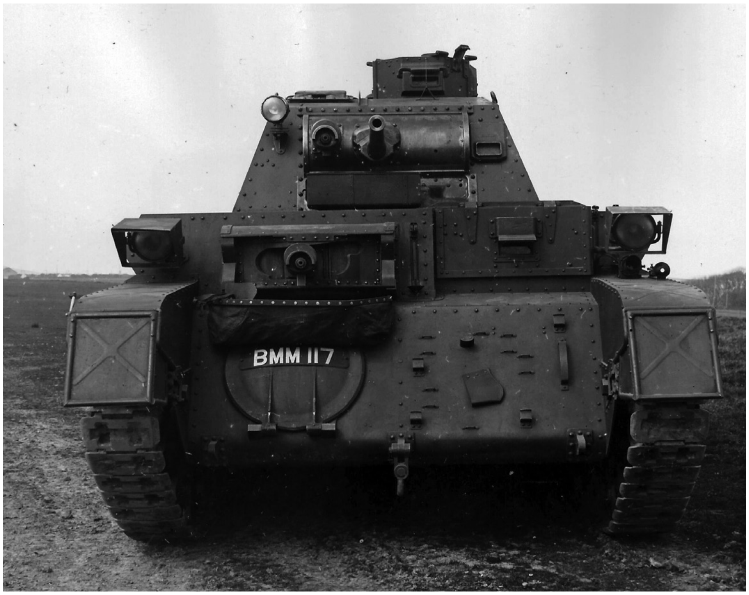
A7E2 was supposed to have a Wilson six-speed combined gear change and sophisticated steering arrangement, but they were not ready in time, so it was initially fitted with an Armstrong-Siddeley five-speed pre-selector gearbox and Rackham steering clutches on the output shafts. It was in this guise that it went to MWEE in 1932. Later that same year the Wilson transmission arrived. A7E2's suspension relied on rollers attached to trailing arms springing against vertical volute springs, so that each unit was independent of its neighbour. It was rather like that adopted for the A22 Churchill of 1940. It had the advantage that any bogie could be damaged or broken without seriously affecting the tank, a contrast to the system on A7E1 where damage to one roller could affect the entire group, and possibly bring the tank to a halt.

Both tanks had identical turrets as already described, and both were lined with Langite, an insulation material, intended to reduce the noise. The turrets were rectangular in plan form with room at the back to house a wireless set. Each was mounted with a 47mm (3-pdr) gun with a Vickers machine gun on its right; the weapons shared a co-axial mount but protruded through independent slots in the turret front. It is said that at one time A7E2 was test-fitted with the new 40mm (2-pdr) gun instead of the 3-pdr, but it has been virtually impossible to prove this.

Both tanks suffered from repeated engine trouble. By 1934 the compensated suspension on A7E1, although judged to be a better gun platform, was just about worn out. A7E2 was fitted with longer springs and tested over a special track dotted with railway sleepers. When it was examined afterwards all suspension units showed

A7E2, a left-side rear view. Although the two tanks had quite different suspension systems, it is not easy to tell them apart except for the different roller spacings – do they really need seven return rollers on each side? The large turret cupolas caused some tank commanders to fear that they might be shot off while their heads were in them, so after a while cupolas disappeared too.





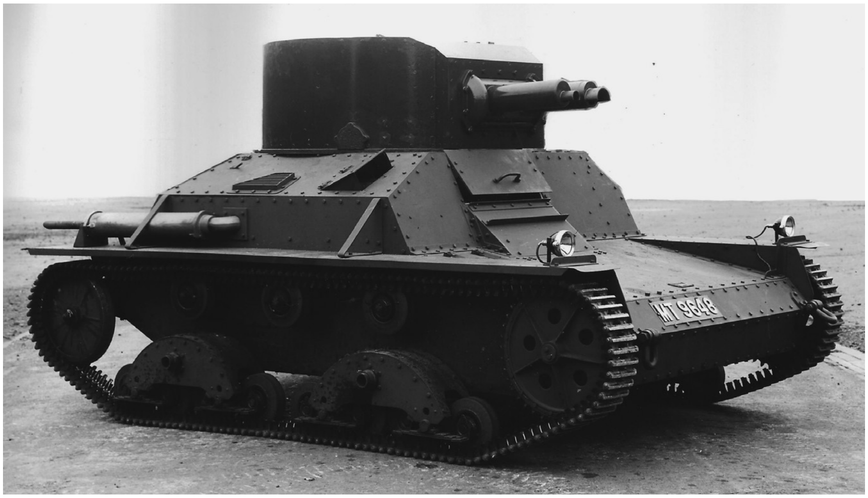
A7E3 was a much better tank, although it still had the less than prominent driver's position and the dominant hull machine gun. The bag below this gun is to catch spent cartridge cases and below that is the manhole cover which has replaced the ridiculous doors, although it is still in the wrong place. Apart from that the tank had a lot going for it, but it didn't last very long.

signs of damage and, although they were repaired, both tanks were scrapped in 1937.

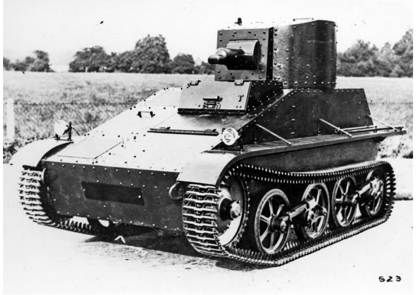
A7E3 was the final medium tank to be built, and arguably one of the best. It was of the A7 family, although that is not immediately obvious. The hull of A7E3 was about the same size as its predecessors, but a bit wider – 9ft 1in high, 22ft 6in long and 8ft 11½in wide – but it is easy to recognize by its mass of raised covers and inspection panels along both sides. The suspension was similar to A7E2, except that helical springs were used instead of volute, and although the number of track return rollers was reduced from seven to six it still appeared to be too many. Armour was once again to a 14mm standard and the driver was still hidden away on the left, his view to the right rather obscured by the prominent machine-gun mounting. At one point, during the design stage, the idea of fitting a small machine-gun turret had been discussed, but in the end a gimbal mounting was settled on, giving a 100-degree arc of fire. Instead of the vulnerable double door arrangement at the front the crew escape hatch took the form of a round manhole cover, still at the front and below the machine-gun position, which did not weaken the front plate so badly. However the day of the Armstrong-Siddeley air-cooled petrol engines was over. Water-cooled diesel engines were very much in favour, and since no suitably large engine had been developed it was decided to use two AEC London bus engines, six-cylinder diesels mounted side by side, which between them delivered over 200hp; this system was also employed in the A12 Matilda tank and was even perpetuated in the M4A2 version of the Sherman. It seems to have been reliable enough, although using two engines adds to the maintenance time and is never as good as an equally powerful single engine. Each engine was direct coupled to a Wilson four-speed pre-selector gearbox with reduction and a Wilson compound epicyclic system was used for steering. The tank was capable of a top speed of 25mph, but the suspension limited it to about 15mph, otherwise it bottomed heavily. Naturally, the engine being water-cooled, a radiator was required, which was fitted at the back of the tank, alongside another one used for cooling oil. The turret was also rectangular and it looked as if a pattern had been set. Once again it had a tall, independently rotating cupola for the commander, but one new feature was an external mantlet at the front which held the guns, a 3-pdr (47mm) and a co-axial Vickers .303. This looked and worked like a roller, and was much more resistant to the ingress of bullet splash than the earlier open slots had been. A7E3 weighed 18 tons 2 cwt, but it more or less marked the end of medium tank development in Britain, although it had a number of features that were used in subsequent designs: the turret on the next generation of cruiser tanks, the suspension on the A22 Churchill and the engines in A12 Matilda. It had probably gone about as far as it could go under the present system. In 1939 it was sent down to Lulworth with a ballasted turret to examine how the heavier turret on a Matilda would behave, after which the running hull, without a turret, was sent over to the Experimental Bridging Establishment at Christchurch to test tank bridges.

Virtually contemporary with A7E3, a new medium tank was ordered from Vickers-Armstrongs under the General Staff specification A8. By all accounts it was never built nor got beyond the wooden model stage, yet it is listed in the register of medium tanks with its own WD number, T1341, and road registration number, BMM 118. The hull and turret were very similar to tanks of the A7 series, although a front-mounted machine-gun turret was under consideration. Power was to be provided by two Rolls-Royce Phantom engines mounted side by side with a Wilson six-speed pre-selector gearbox between them linked to steering epicyclics on the cross shaft. A Vickers box bogie suspension had been considered, but this had not been decided upon definitively, and it was thought that after trials with the Horstmann system on A6E3, it might have been adopted instead. In the event the entire project was abandoned and the prototype, A8E1, never built.

British light tanks will be covered in the next chapter, although one of them, A5E1, deserves to be expanded upon. A5E1 was an interesting tank, it was ready for testing in 1930 and falls, chronologically, between the light tanks Mark I of 1929 and the Mark IA of 1930, making it very early indeed. Not having an internal diagram available, we can only guess at the layout, but the engine, a Meadows six-cylinder EPC rated at 60bhp was situated on the right side, driving into a two-speed gearbox with two-ratio epicyclic reduction, while the driver sat more or less ahead of it, again more to the right side. The armoured hull was raised, with sloping sides as on the Lights Mark IA and II. It is listed as a three-man light tank, so in addition to the driver there must have been two men in the turret. This looks very similar to the type fitted to Lanchester armoured cars, without the cupola but armed with two Vickers water-cooled machine-guns side by side: a .50in heavy and a .303in medium. The turret was quite large and seems to overpower the tank. Weighing only 4½ tons it was still one ton heavier than a two-man light tank, which may account for the unusual suspension system adopted for this tank. It consisted of two bogies on each side, pivoting on tubes running across the hull. Each bogie consisted of a hefty, hemispherical casting with a typical Carden-Loyd-type roller assembly at each end. This comprised two rubber-tyred rollers, each pair sharing a very short leaf spring, which appears to be all the



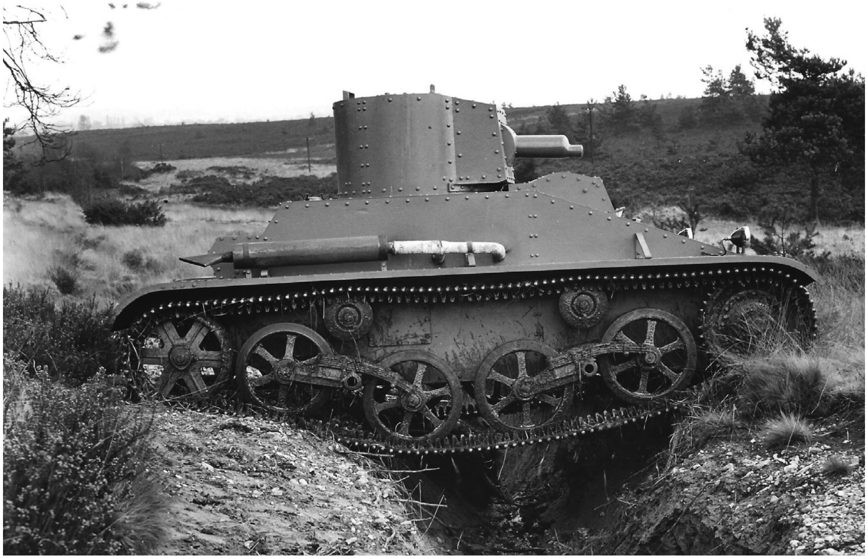
A5E1, the first Vickers-Armstrongs three-man light tank with two machine guns, photographed at Farnborough. The suspension makes it look heavy, but it only weighed 4½ tons, and despite later modifications never saw regimental service.



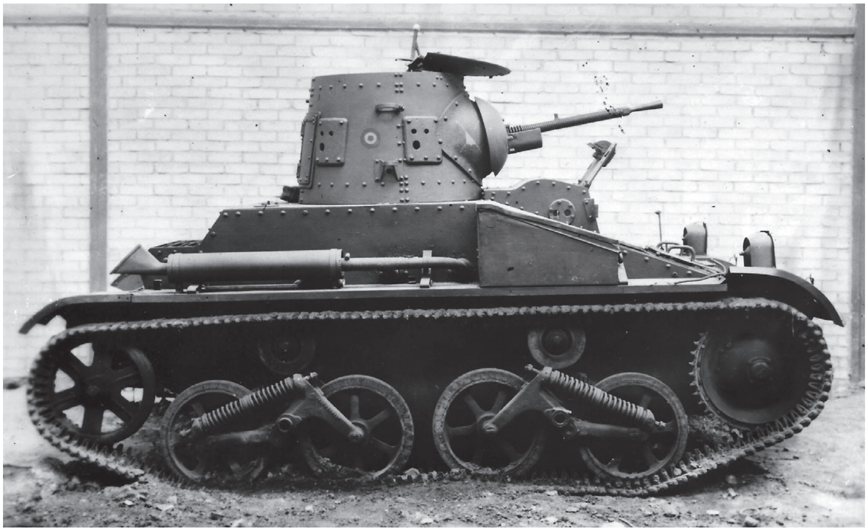
A Vickers-Armstrongs Light Tank about which very little is known. It may have been an early commercial design, but if so none appear to have been sold. Notice that the suspension lacks an independent rear idler, like some of the early Vickers tractors. One assumes it was a two-man tank.

springing there was, although each bogie was capable of some compensated action. The suspension looks as if it would be suited to a much heavier tank, but the armour on A5E1 was only 9mm thick. The tracks, and all the other suspension components, drive sprockets, idlers and return rollers, are the standard Vickers-Armstrongs type. The tank had its suspension changed in 1931, and the new system is described as of the Horstmann type, with individual road wheels on swinging arms sprung by long coil springs acting on the return rollers. No picture of the tank with this modification has yet been seen, so it cannot be said how many suspension units were involved, but in 1932 a more powerful Meadows engine, a type ESC rated at 100bhp, was fitted along with a more substantial gearbox. However after 1932 this interesting tank vanishes altogether.

Vickers-Armstrongs began to design a range of light tanks for commercial sale in 1933. They were not permitted to include any features that emanated from official design establishments, only those they developed themselves, but this still seems to have given them a lot of scope. One of the first we only know from a single photograph; we have no other details, but it may be the very first one for all we know. It is unusual since it runs on a type of suspension seen on the Vickers-Armstrongs Light Amphibious Tank, with leaf springs but no separate idler wheel at the back. Otherwise the shape of the hull and driver's position, the small, rounded turret armed with a single Vickers machine gun, all of these are identical to the range of light tanks produced subsequently. The type identified as M1933 was virtually the same but with an idler; one example was sold to Finland where it is still retained, while others went to Lithuania and one to Switzerland. The Swiss order is interesting since it included a second tank, virtually identical to the first but with coil, instead of leaf-spring suspension. This type became known as M1934, a few more of which went to Switzerland and a much larger order to Argentina. However the biggest order,



M1933 was another commercial design, with an independent rear idler. It may have given a better ride, and certainly allowed wider trench crossing. Only a few were sold, notably one to Finland where it still survives.

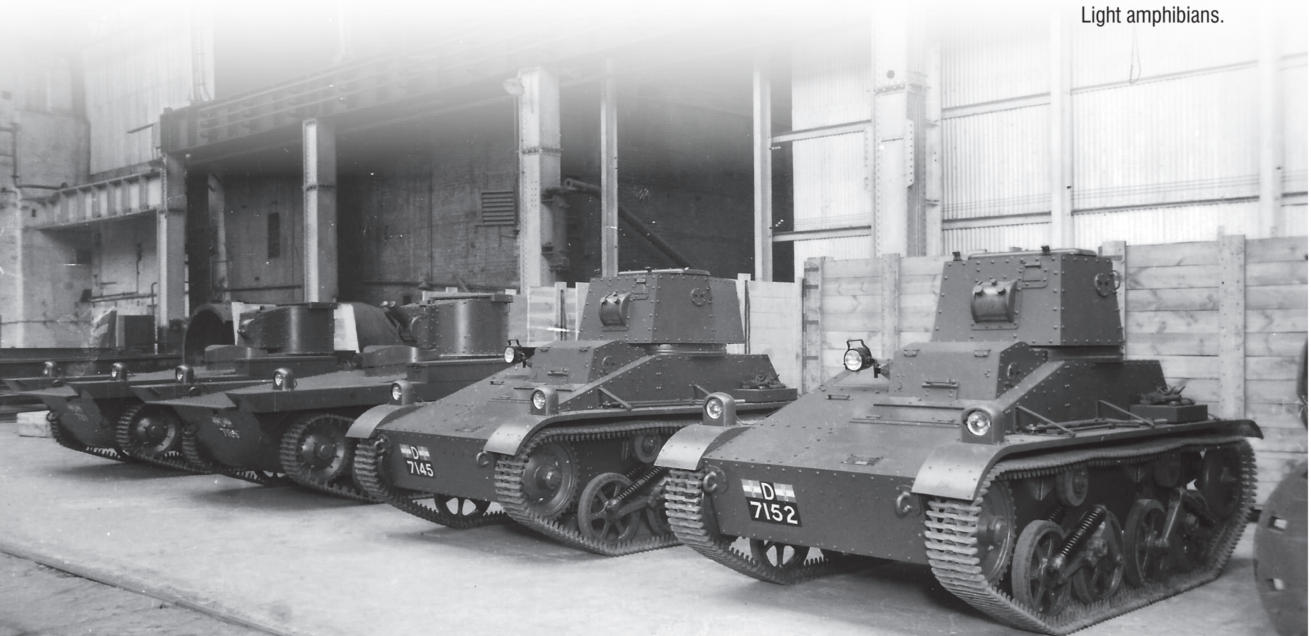


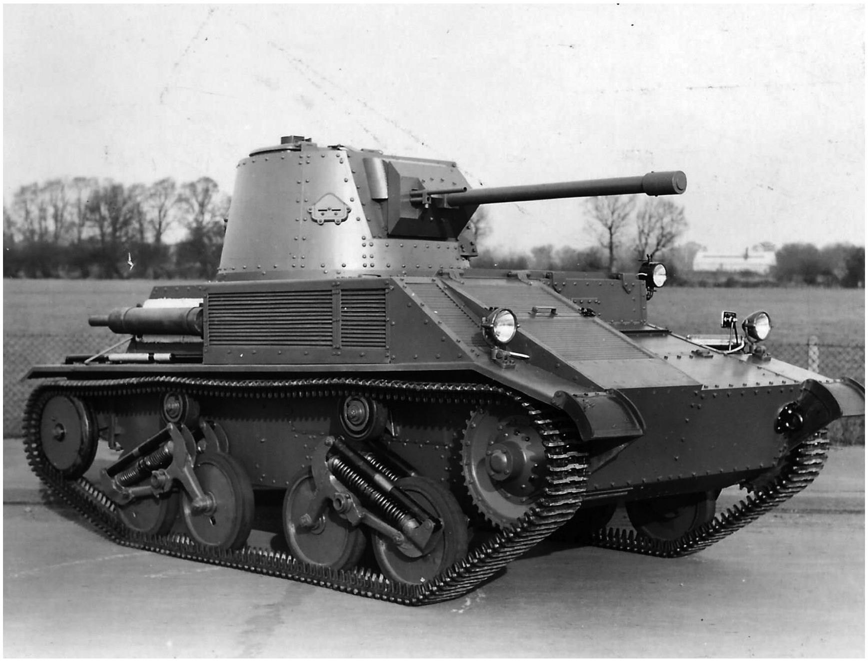
Known to the Belgians as the T15, this was a later commercial design with coil spring suspension. Normally sold with the standard round turret, the Belgians specified a taller, more conical one to mount their choice of machine gun.

amounting to 42 tanks in all, went to Belgium. The Belgians wanted a special turret to take the 13.5mm Hotchkiss machine-gun. The turret, which was a somewhat taller, slightly conical affair, was duly supplied, the tanks entering Belgian Army service as their model T15.

From 1935 another light tank was introduced with the same hull and running gear, but now carrying an angular, rather than a rounded, turret. Substantial orders were received for these from China, Lithuania and Latvia along with a smaller one from Holland. Six of those ordered by Latvia were delivered with an enlarged turret and 40mm gun, not the British 2-pdr but a Vickers-Armstrongs semi-automatic weapon of slightly inferior performance. One of these survives in the Russian Tank Museum at Kubinka. The Dutch followed their order with one for the Army in the Dutch East Indies, although 48 of these were confiscated by the British Government because they were still being built when war broke out in September 1939. These entered British service as the Mark IIIB, although they are generally known as Dutchmen. Some were even delivered to Greece in 1941 and duly lost to the Germans.

The so-called Dutchmen, commercial light tanks with coil suspension and angular turrets, a number of which were impounded for the British Army in 1940. They were photographed in the Vickers-Armstrongs factory at Newcastle along with some Vickers-Carden-Loyd Light amphibians.

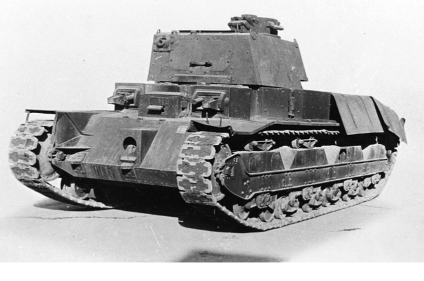




The impressive Vickers Command Tank. It mounted a 40mm gun in what looks like a six-tonner turret. Additional shock absorbers have been added to the suspension, while the road wheels are disc rather than spoked pattern. Although the tank survived the war it was never a commercial success.

The Vickers-Armstrongs Light Amphibious Tank was also a considerable export success, with substantial numbers going to Russia and China and smaller orders to Holland, Finland and Siam, along with two, already mentioned, to the British Army. The tanks are interesting, since, in addition to being fully amphibious without any preparation, they had two different types of steering systems in the water. Some had a fairly conventional arrangement with a separate rudder behind the propeller, but others, such as the two supplied to Britain, had the propeller encased in a moveable cowl that turned like a rudder but took the prop with it. The outbreak of war brought a sudden end to Vickers-Armstrongs' commercial activities, but they had one last try in 1938. This was the Vickers-Armstrongs Command Tank, a three-man machine armed with a 40mm gun and a good deal larger than any of their previous light tanks. Indeed there is something about it that reminds one of the six-ton medium tank, although the suspension was a modified version of the light tank design. Belgium was reckoned to be the most likely customer and the tank was shipped there in February 1938. However the manufacturers discovered that the tank had been placed on the War Office Secret List, because, according to the War Office, it had features that were similar to the Light Tank Mark VI, which was classified. In some respects the new tank was a lot better than the Light Mark VI, in terms of firepower, for instance. Belgium showed some interest in the tank, and although it was subsequently removed from the Secret List none ever went to Belgium, or was built there. The prototype languished at Chertsey during the war and seems to have been scrapped soon afterwards.

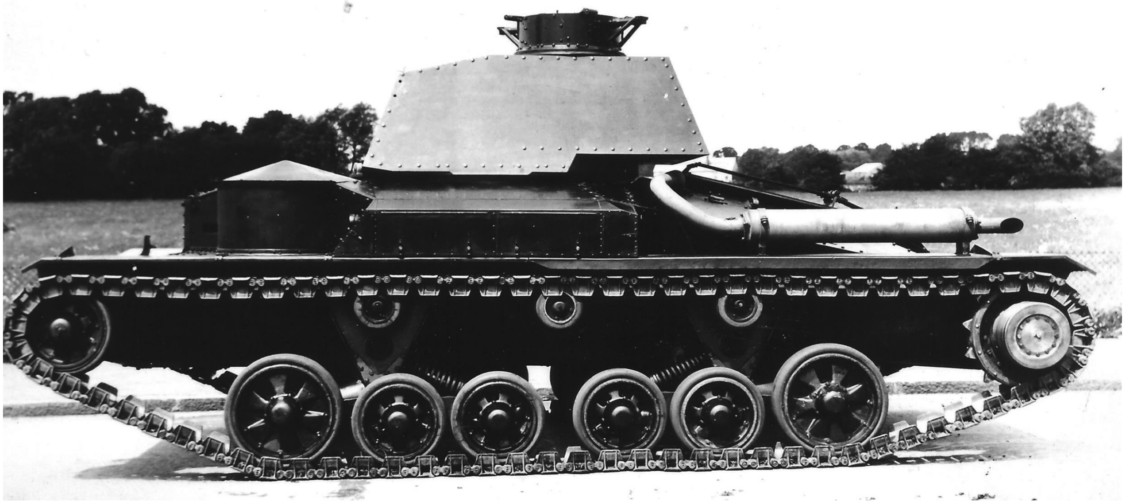
The next tanks were all classed as Heavy Cruisers although two of them were effectively medium tanks under another name. These two were classified



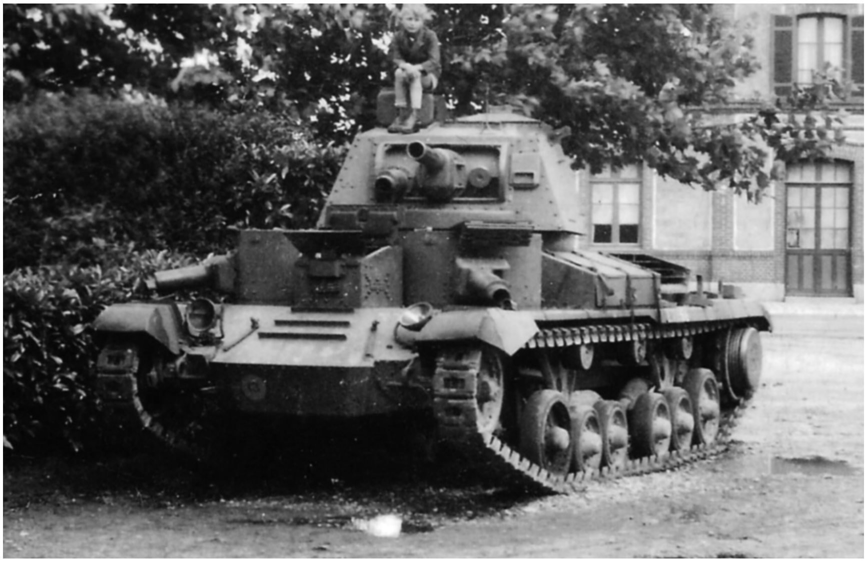
The idea of a Heavy Cruiser was fashionable for a while, although it would have mounted the same gun as an ordinary cruiser. This is the prototype A14E1 designed and built by the London, Midland & Scottish Railway Co. at Crewe. None of its three turrets mount any weapons at all.

A14 and A15, of which A14 at least progressed to the prototype stage, although A15 never even got that far. A16, which looked a lot more modern with its Christie suspension, will be dealt with later. However it is worth remarking at the outset that all three of the new designs were specified to carry the 40mm (2-pdr) gun, nothing larger, so in terms of firepower they were no better than some of the smaller cruiser tanks, or indeed the infantry tanks that followed them. A14 was built by the London, Midland and Scottish Railway Company (the LMS) in their locomotive works at Crewe, in Cheshire, screened off from general view. Like A6E3 in its final form A14 employed the Horstmann suspension and the Thornycroft RY/12 engine. The RY/12 was a V12 petrol engine rated at 500hp and designed for marine application. It was a bit big for a tank, but powerful and seemingly reliable enough. In A14 it was linked to a Wilson pneumatic pre-selector eight-speed combined steering and gear change unit, which was also large and heavy. A14 was to be built with 30mm armour standard in mind, with two auxiliary machine-gun turrets at the front, either side of the driver's head cover, but designed to carry the Czechoslovakian ZB air-cooled machine-gun, later to be made in Britain as the Besa. The main turret was rectangular, based on the type fitted to the A7 series Mediums to carry a 2-pdr and co-axial ZB, although no armament was ever fitted to this tank. At 29 tons A14 was considered overweight, as 25 tons had been the agreed top weight. However there was no immediate requirement for these large cruisers, so the tank was not developed further and its sister A14E2 was never completed. The transmission is held in the Tank Museum collection but the hull was used as a hard target.

A15 never got as far as the wooden mock-up stage. It would have been a gunner's delight, the central turret mounting a 40mm anti-tank gun alongside a medium-range howitzer (probably the three-inch) and a ZB air-cooled machine gun, the vaunted triple mount that was much favoured at the time. A further ZB machine gun was to be mounted for anti-aircraft use, probably in the turret roof. No less than three auxiliary machine-gun turrets would be fitted, each carrying a pair of ZB machine guns, two in front of the main turret on each side. Each of these would also have been fitted with a smoke mortar, and third machine-gun turret was placed at the back, behind the main turret. This suggests a crew of seven minimum, probably



The prototype Medium Mark IV (A9E1) in its original form. It had a nasty habit of shedding its tracks and had to be redesigned, although it still featured Sir John Carden's 'Bright Idea' suspension.



An A9E1 Cruiser Mark I close support tank, abandoned in France, hence the small boy sitting on top of it. Suspension layout has been redesigned, but the auxiliary machine-gun turrets turned out to be a blasted nuisance, especially in the desert.

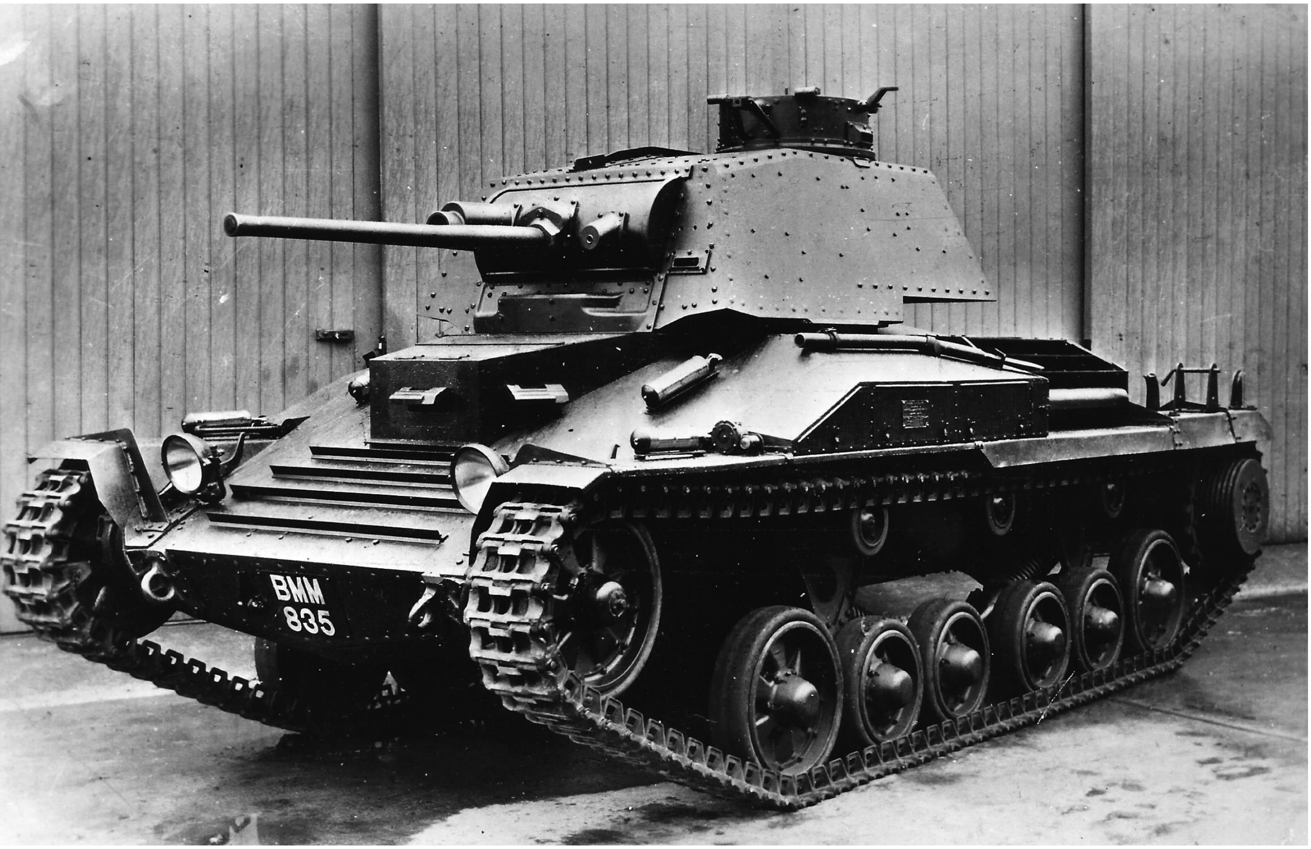
eight. Armour would be on a 30mm basis, Horstmann suspension was considered and a top speed of 25mph was expected. Nothing is said about a favoured engine, or engines, but Wilson epicyclic transmission was mentioned. As it was, the tank was going to be too wide for the British railway loading gauge, and a suggestion that it might fit the slightly wider continental loading gauge was rejected, so it was dropped, the designation A15 being awarded instead to the later Crusader cruiser tank.

Back in 1934 Sir John Carden, Vickers-Armstrongs' chief tank designer, was instructed to start work on designing a new tank to be designated Medium Tank Mark IV, with the General Staff number A9. Although still very vague regarding details and priorities, the General Staff at least knew that previous types, notably the A6 series and the Medium Tank Mark III were too expensive. They wanted something cheaper and price would dictate many features, although the General Staff had some ideas of their own. The new tank was to be powered by a single engine instead of the pair used in A7E3 and proposed for A8, yet the top speed should be about 25mph. Armour was to be to a 14mm standard and front mounted machine guns were to cover an arc of fire of at least 190 degrees. They also wanted good trench-crossing ability, and all within a maximum weight of seven tons.

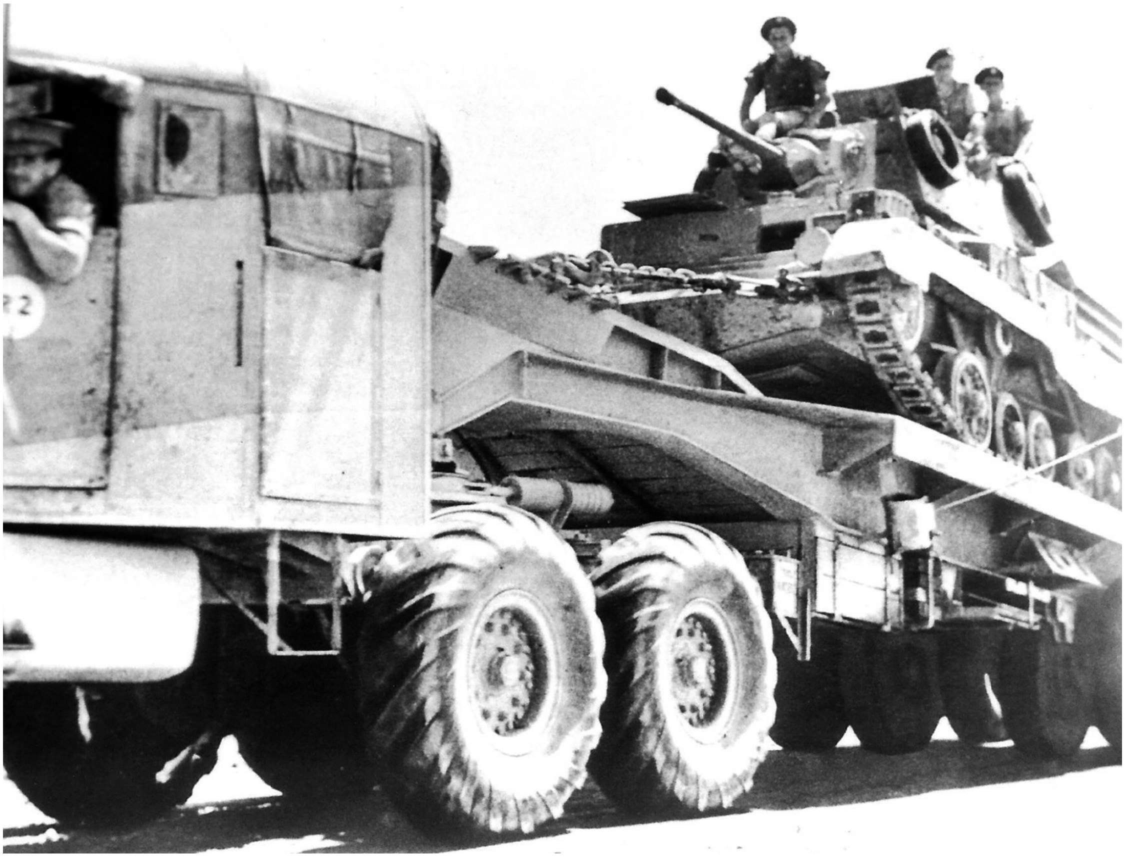
The prototype was completed in 1936. Although it lacked armament, it was already three tons overweight. In the meantime Carden himself had died in an air crash in December 1935, so he was not on hand to deal with any of the problems inevitable in a new design. Even so, he had designed a good tank within the limits. His greatest achievement was undoubtedly what was known as his 'bright-idea' suspension, but which Vickers referred to as their 'slow-motion' type. This consisted of two bogies on each side of the tank, each of which featured three rubber-tyred rollers, one of 24in diameter and two smaller. Each bogie was arranged so that the larger roller was at the outer end, and was attached to the hull at a single point. Even so, the suspension was remarkably flexible, the rollers were attached to a jointed sub-frame with a powerful spring at its inner end. The whole thing was capable of swinging to a remarkable degree and gave a reasonably comfortable ride. The tank was originally powered by a Rolls-Royce Phantom II engine driving through a Meadows five-speed gearbox and with clutch and brake steering at the final drive. This was also unusual. Since the brake drum for the track brakes was located on the outside of the drive sprocket to save space, it was independently armoured for protection and fitted with grooves around the drum so that it was cooled by passing air.

In order to save weight Carden had made the hull as compact as possible and used angled plates of thinner material that were equivalent to 14mm plates set vertically. Even so, there was nothing he could do about the machine-gun turrets at the front. Not only did they create some appalling shot traps – for instance, where they passed close to the driver's cab – but they also made it impossible to fit additional armour over the frontal area when this was required. The logic behind frontal machine-gun turrets was a War Office belief that they were needed as an antidote to enemy machine guns, since the 2-pdr, firing solid shot, could only deal with other armoured vehicles. This being so, one imagines that they should have been a requisite on infantry tanks, but they had to rely on a co-axial weapon, except in the case of the Mark I. The Crusader was the only other cruiser tank to mount an auxiliary turret, and that not for very long. One might wonder how easy it was for someone inside a tiny machine-gun turret to pick out an enemy weapon, never mind fire at it. Conditions inside are said to have been appalling in a hot climate.

Early trials and demonstrations revealed that the suspension was too lively and it had a tendency to throw tracks. This was revised by Vickers by moving the two bogies further apart and introducing shock absorbers. The track was a novel system, using two pins between links, filled with grease and sealed so it never needed recharging. This should have led to smoother running tracks, although of course they did leak



A10E1 was originally intended as an infantry tank, but its armour was not thick enough. Even so, to begin with it was well designed with sloping frontal armour. Note its tracks, quite a new design, which were used later on the Valentine.



A10 entered service as the Cruiser Mark II, now with a vertical front plate with the driver moved across to the left. It was now running on double-pin, lubricated tracks, the same as A9, but they could be troublesome on sand. It is shown riding on the back of a Scammell tank transporter.

and attracted grit, so track wear became a problem. Similar tracks were fitted to the A10, the A9's heavier sister tank, but they were never used again. A more powerful engine was also required, so in place of the Rolls-Royce an AEC six-cylinder unit was chosen. Rated at 150hp, it was a petrol version of the 9.64-litre diesel engine used in some AEC buses, but driving through the same gearbox and final drive.

The turret was the first in British service to be fitted with a power traverse system. This was hydraulically powered, although concern over the flammability of hydraulic fluid meant that later on an electric system was preferred. A9, now styled as the Cruiser Tank Mark I, entered service towards the end of 1939. An order for 50 was placed with Vickers-Armstrongs, followed by a further 75 from Harland and Wolff of which 36 were completed as Close Support tanks armed with a 3.7in breech-loading mortar in place of the 2-pdr.

There was talk of an A9 being fitted with a searchlight turret, but nothing ever came of it. The prototype (A9E1) was used to test a mine-roller device, which is said to have been built by Alfred Barnes of the Albion Works Rhyl, while one is reputed to have been tested with a carpet-laying device of hessian at the front. A9E1, now with its gun removed, was also used in 1940 for submerged river-crossing trials in the Stour at Christchurch.

The A10, the sister tank to the A9, was intended for infantry support and therefore more thickly armoured. It used the same engine and transmission, albeit with lower gears to allow for the additional weight. It used the same suspension but wider, dry pin tracks and had armour to a 30mm standard, and originally at least a more streamlined appearance with no hull-mounted machine gun at all, which is odd given its intended role. Then, in the summer of 1937 the War Office changed its mind and decided it wanted a hull machine gun after all, so the tank went back to Newcastle to be rebuilt. When it re-emerged it had a vertical front plate with the driver moved over to the left side. What is even odder is that the hull machine-gun position was equipped to receive the new Czech ZB53 air-cooled machine gun, yet the turrets were built with the old Vickers .303in water-cooled weapon. As a result the first batch of tanks, with the Vickers co-axial weapon, had the hull machine-gun position blanked off. The argument was that two types of machine-gun ammunition in one tank would be confusing, never mind that it seems to have been done quite happily in early Vickers mediums. Nevertheless, the front end of the A10 could have remained as it was, at least for this first batch. The A10's turret was identical to that fitted to the A9, albeit with thicker armour, and it also mounted the 2-pdr gun or the 3.7in close-support mortar.

In their next revised decision the War Office concluded, in 1938, that frontal armour for an infantry tank needed to be at least 60mm thick, so the A10 was reclassified as a heavy cruiser, but later given the official designation Cruiser Mark II. Thicker armour was achieved by a process termed composite armour. This meant that the hull and turret of the tank were first assembled from thin panels of more malleable steel and the required thickness, of 30mm in this case, was achieved by fitting a layer of proper armour plate to the external surfaces. As a practice this was not deemed as good as using single plates of the required thickness, but it made assembly easier and of course was that much cheaper.

A second batch of tanks, styled Mark IIA, were built with air-cooled Besa machine guns, the British version of the Czech weapon co-axially mounted in the turret and in the hull front position, but it will be noted that neither the A9 or the A10 had a commander's cupola on the turret. By the time it appeared as a cruiser tank, A10 had reverted to using the double-pin lubricated tracks also seen on the A9. Total production of the A9 and the A10 ran to about 396 tanks, 126 of them A9s. But with war imminent, a new cruiser tank was under development with a new suspension system. One A10 served as the basis for an experimental scissors bridge, developed at Christchurch, but it is the only modification of this tank ever recorded.

A9 and A10 tanks served with British 1st Armoured Division in France, but they played second fiddle to the new A13 Cruisers in all six regiments, many being employed in the close-support role. They were also operational in North Africa, particularly in Libya. Some Cruisers, mostly A10 type, were sent to Greece in 1941, but all had to be left behind when the Germans overran the country.

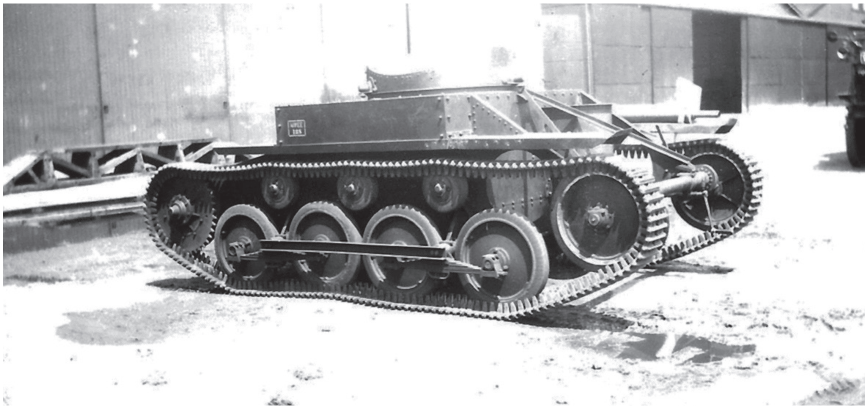
CHAPTER 10

LIGHT TANKS 1927–45

MARKS I–VI

There is one British tank that fought in virtually every tank battle involving British armour from the outbreak of World War II until 1941, but which rarely, if ever, gets a mention in any modern accounts. The tank in question is the Light Tank Mark VI, specifically the VIB and VIC.

They operated in France with the British Expeditionary Force (and would have fought in Norway if the ship carrying them had not been sunk), in the Western Desert, in Italian East Africa, in Greece with the 4th Hussars, in Malta, in Cyprus and in Syria with the Australians. They served in Iran with the 14th/20th Hussars, in India they operated with British and Indian regiments on the North-West Frontier and a few, formed as a light-tank company, were rushed to Singapore in December 1941 in a vain effort to stem the Japanese advance through Malaya. Meanwhile, B Squadron, 3rd Hussars, detached from its regiment in the Middle East, was sent by sea to Singapore. The Japanese scuppered that plan, and after a short spell on Sumatra the squadron landed in Java. However, it was once again too late, and ended up destroying its tanks and surrendering.



In addition to India, both Australia and Canada received deliveries of variants of the Light Tank Mark VI, particularly for training purposes. In both countries they were also available for home defence, should the need ever arise, as indeed they were in Britain. They were even used by the Germans; an officer named Becker acquired many captured tanks and converted them into an impressive range of small, self-propelled guns, as well as supply and command vehicles. There are enough stories here to fill a fair-sized book on the Light Tanks alone.

Of course, before the Mark VI there were other types, including some interesting prototypes. They played a significant part in the story of the mechanization of the British Army.

PROTOTYPES AND PREDECESSORS

Apart from the strange machine with a turret at each end built by Royal Ordnance in 1924, sometimes referred to as the three-man light tank and sometimes as a machine-gun carrier, the first light tank proper to come to the notice of the British Army was the Carden-Loyd Mark VII, which was shown in a War Office booklet published in 1930. It was built by Vickers-Carden-Loyd Ltd in 1928 and displays its Carden-Loyd lineage in the suspension system. The booklet says that it was the first light tank with a revolving turret, although that is questionable, and it goes on to say that it 'has considerable mechanical defects but showed great promise'. If what evolved from it is any guide, then that is quite true, although looking at it one feels that it must also have been terribly cramped inside, even for a two-man crew.

In September 1928 a contract was signed for a further four tanks from Vickers-Carden-Loyd, which were designated the Light Tank Mark I. The publication mentioned above had this to say about them: 'A vastly better fighting machine. The turret is geared and mechanically great improvements have been made. This Light Tank is considered sufficiently satisfactory to put into the Service. Messrs. Vickers Armstrong [sic] are responsible for the design.'

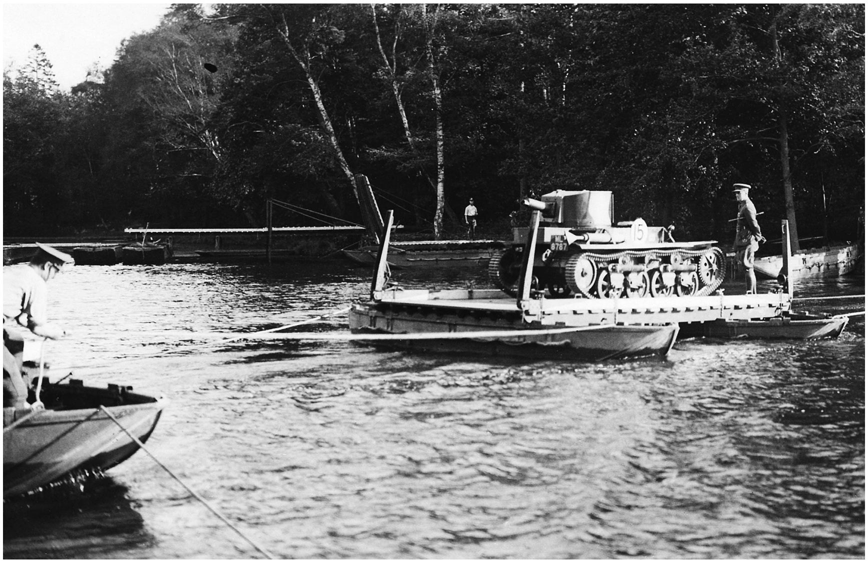
The mechanical improvements are not specified, but the engine, a Meadows-type EOC straight-six, was said to be 'improved', although it could only deliver the same 59bhp as its predecessor. Other sources mention a two-plus-two gearbox, presumably like the original Carden-Loyd system, and tiller steering. The most obvious mechanical improvement has to be the suspension. Vickers moved away from the Carden-Loyd arrangement, with the external, horizontal bar, and opted instead for a Horstmann design in which pairs of spoked road wheels were linked by a cast bracket and a quarter-elliptical leaf spring. It undoubtedly gave a rough ride, but much better was to come. The hull shape was improved and, although a crew of two was retained, the men now had more headroom. There was a raised cover for the driver to use and the turret was a good deal taller than the first type. Whether, as the book claims, it could mount a .50in machine gun as an alternative to the .303in appears to be doubtful, but the fact that the turret was 'geared' is interesting. It was traversed by turning a handle, which then turned a gear wheel that meshed with a toothed turret ring

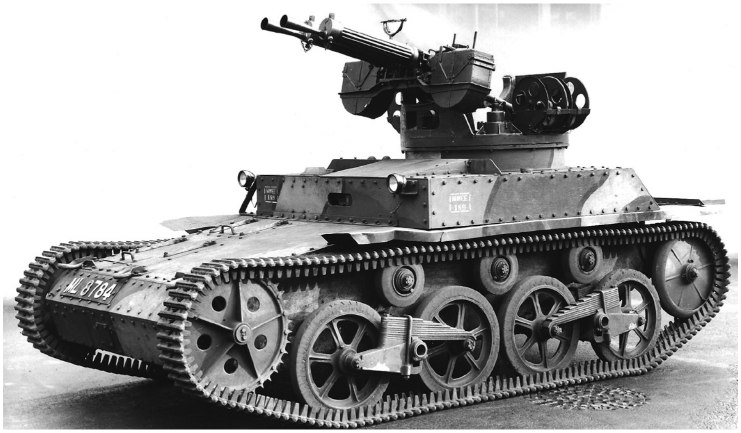
All four tanks went to the Mechanical Warfare Experimental Establishment (MWEE) in October 1929 and remained there until early 1933. Three of them appear to have been identical, but the fourth, A4E2, was supplied with a twin .50in anti-aircraft mount, using a pair of Vickers water-cooled heavy machine guns. It was a mounting that the company seemed keen to promote, since it was also seen on a

Opposite The original Light Tank A4E1 seen outside the hangars at Farnborough and photographed from the rear. The suspension features the external beam, typical of the earlier Carden-Loyd carriers. The shallow machine-gun turret would have been very cramped.

Right This photograph shows A4E5 (T494 ML8787) on a raft being ferried across what is assumed to be the Basingstoke Canal. The tank has its turret reversed and appears to be camouflage-painted. It also features what appears to be a revised suspension with horizontal coil springs.

Below A4E2 shown here with the special anti-aircraft armament of a matched pair of Vickers .50in water-cooled heavy machine guns in an open mounting. Quite where the gunner went is not obvious.



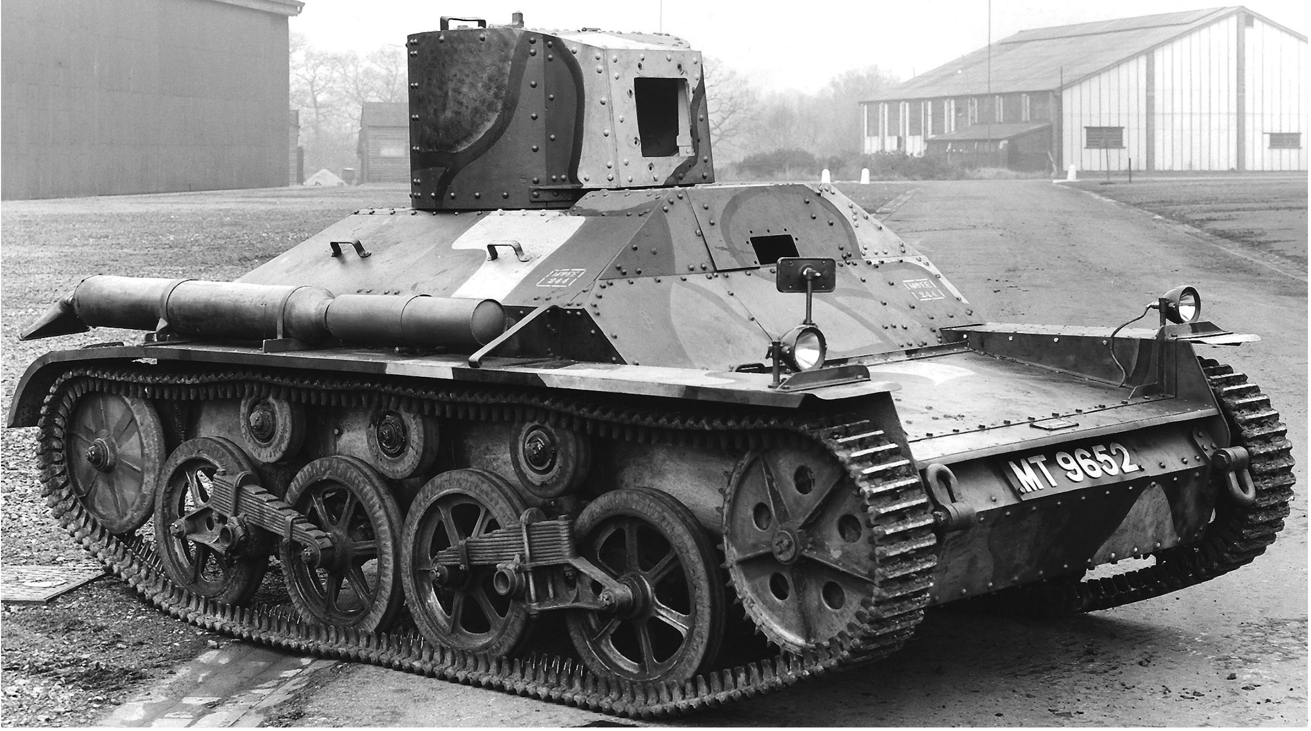


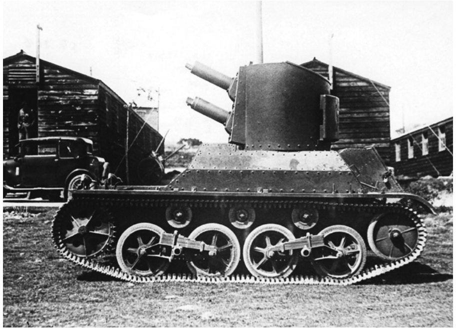
prototype Crossley 6x4 armoured car. Figures quoted by MWEE for all four tanks give a maximum armour thickness of 14mm, a weight of around 3.2 tons and a maximum road speed of 35mph.

By the time these tanks were released from MWEE in 1933 they were clearly obsolete, but since they were regarded only as prototypes they are unlikely to have entered service in the sense of being issued to Royal Tank Corps battalions. There may have been trips down to Bovington and Lulworth for mechanical and gunnery trials, and one was certainly used at a military display where it was rafted across a river, but all, presumably, under the auspices of MWEE.

Meanwhile a further five tanks were ordered from Vickers-Carden-Loyd and delivered to MWEE in 1930. They were classified by the manufacturer as the Carden-Loyd Mark VIII, although they were known to the War Office as the Light Tank Mark IA. Like the Mark I they were still only prototypes, and although two of them were issued briefly to 5th Battalion, Royal Tank Corps at Tidworth on Salisbury Plain, they were mostly used as trial vehicles to try out improved suspension systems or (in two cases) different engines and transmission, in particular a Ricardo S65 diesel engine and a Dorman gearbox. One was sent out for trials in the Middle East.

The most interesting of these vehicles was the fifth, A4E10, which had a special, tall turret that mounted two machine guns, one above the other, and seems to have spent much of its time at Lulworth. Otherwise, the new tanks were similar to the first batch, but with higher sloped sides on the hull, which created more headroom for the crew, although in order to keep the weight down, armour thickness was reduced from 14mm to 9mm, offset to some extent by the use of sloped plates.



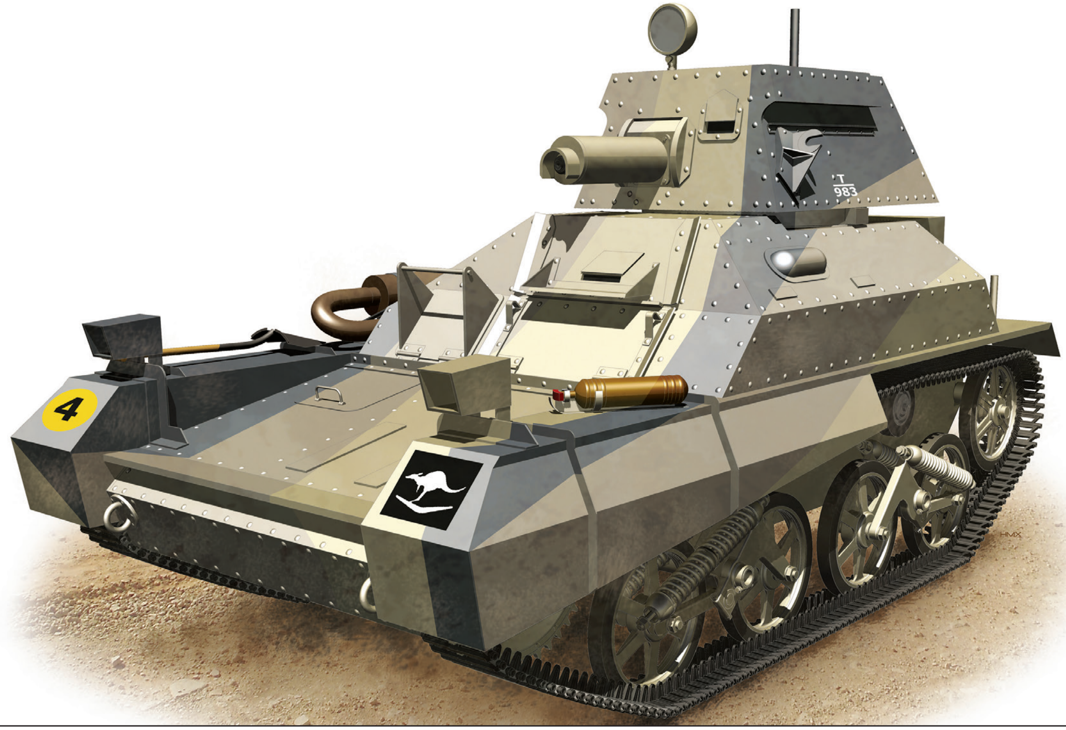


Four of these tanks were also built for trials in India. They all appear to have had the second type of suspension fitted, designed by Horstmann, and it seems that they performed very well. Following trials at Chaklala the tanks embarked upon a 270-mile road trip to Razmak, deep in North-West Frontier territory. They completed this as part of a convoy of wheeled vehicles, with which they were able to keep pace. At Razmak they were tested in the mountains, where they climbed steep scree slopes and coped well with snow, much to the dismay of local tribesmen who were more used to the road-bound armoured cars. The tanks were also used to test various designs of turret cupola that commanders found useful when under fire in the passes. They can be readily identified by the extra ventilation panels on the right side, above the engine.

One thing that plagued this entire family of tanks was the springiness of the suspension, which made accurate firing on the move almost impossible. Of course, it made for excellent performance both on and off the road, but in an era when firing on the move was part of the whole raison d'être of Royal Tank Corps policy this was regarded as quite a handicap, as indeed was the vehicle's tendency to throw a track. This may explain the logic behind another unusual light tank, which appeared in 1930. It was a peculiar thing, and the whole point appears to have been to create a tank with a suspension stiff enough to make it capable of firing on the move. The suspension, which has a rather stolid appearance including short, limited deflection leaf springs, cannot have made for such a smooth ride. Later it is reported to have been fitted with a Horstmann-type suspension, but no photograph of this has yet been found. Despite its hefty appearance, it weighed less than five tons and had a

Above A4E6, the first Light Tank Mark IA, was later fitted experimentally with a Ricardo S65 diesel engine. It is shown here, camouflage-painted but without a weapon mounting, outside the vehicle hangars at Farnborough. It was also fitted with a Dorman gearbox, but still retains the original, leaf-spring suspension.

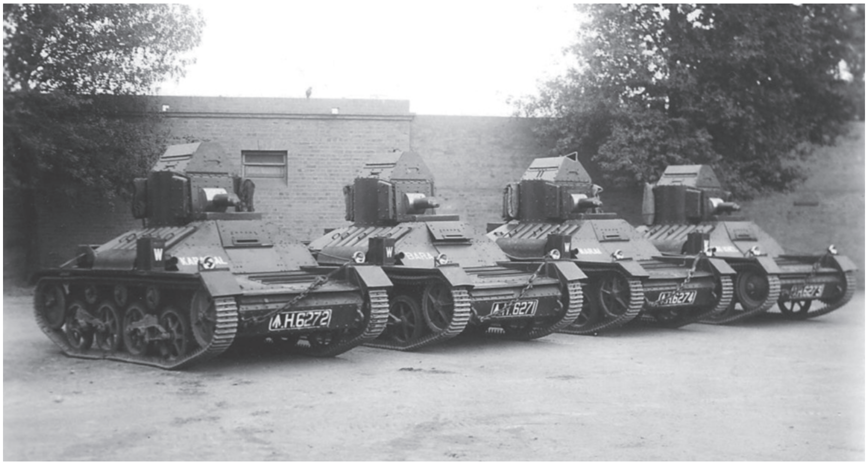
Inset Above A very unusual arrangement: the prototype Mark IA A4E10 with a tall turret mounting two machine guns. It was photographed at Lulworth, where it had gone for gunnery trials, but the purpose behind this curious modification has never been properly explained.



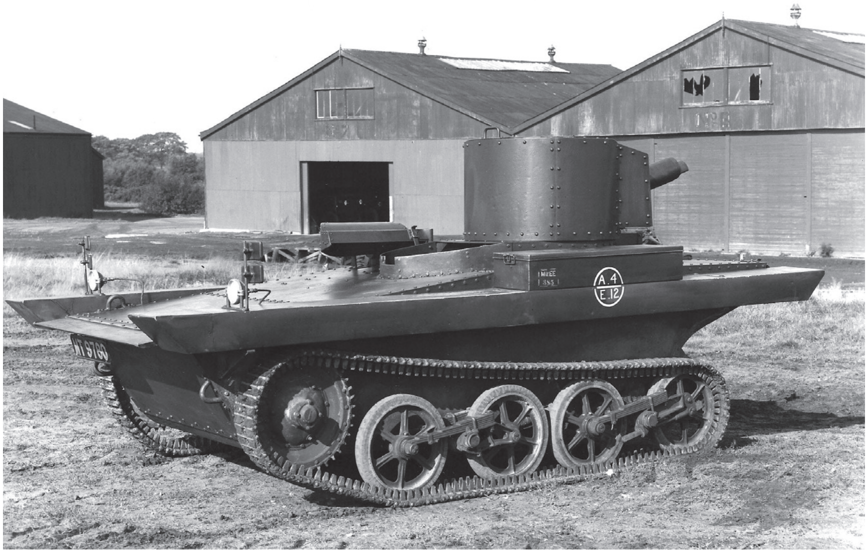
LIGHT TANK MARK IIB, 6th AUSTRALIAN CAVALRY REGIMENT, EGYPT 1940

The Light Tank Mark II series was getting a bit long in the tooth by 1940, having been built in 1930–31. However the Mark IIs, with an assortment of Universal Carriers, were all that were available to equip the Australians when they arrived in the Middle East in 1940. In October 1940 the Australian 6th Divisional Cavalry Regiment was issued with six of these light tanks, described as 'very well used', to supplement their Carriers. The tanks were painted in the angular camouflage scheme, known as the Caunter Pattern after Brigadier J.A.L. 'Blood' Caunter who devised it. The tanks were even older than those the regiment had trained on in Australia, although the latter were few in number and only available briefly for initial training.

The Light Tank Mark IIB was a two-man machine with an enlarged turret, powered by a Rolls-Royce six-cylinder engine and quite fast enough in its day, but poorly armoured and prone to break down unless nursed very carefully. However, since they were all that was available to begin with they had to do, although when they went into action the Australians preferred to use the Carriers than the light tanks, which were both few in number and unreliable. Subsequently the regiment's A Squadron, then serving as part of the Western Desert Force, was partially equipped with captured Italian medium tanks for the attack on Tobruk. These tanks had been captured in large numbers during the battle of Beda Fomm in February 1941. (Art by Henry Morshead, © Osprey Publishing)



The four prototype Light Tanks Mark IA built for India, posing for a photograph at Chaklala. All four are now fitted with the final design of turret cupola, deemed essential for use on the North-West Frontier. These tanks were only ever trials vehicles.



Only two of the amphibious light tanks were tested in British Army service. This is the second of them, T986, photographed outside the hangars at Farnborough. These tanks had the cowled propeller, instead of the separate rudder arrangement seen on some commercial examples.

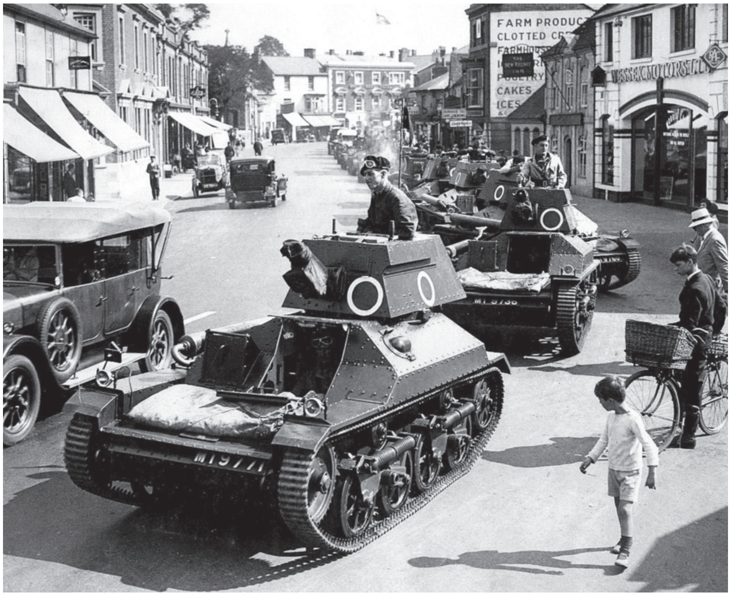
respectable top speed of 28mph. Although the design was never repeated, it was the first three-man light tank armed with a pair of machine guns in what was described as a Lanchester-type turret.

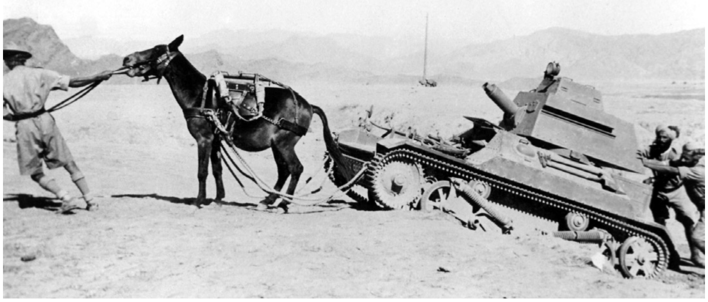
LIGHT TANK MARK II

Now that the trial period was over it was time to begin building production tanks for service use, and an initial order for 16 was placed in December 1930. A total of 12 would come from Vickers-Armstrongs while the remaining four would come from the government's own Royal Ordnance Factory. There is nothing to distinguish them, and the only way to tell them apart is by their War Department or civil registration numbers; although they are easily distinguished from their predecessors, the Mark IA, by the shape of the turret. Designed by the Royal Ordnance Factory, this was rectangular in plan view, with sloped sides and rear. Much larger than the rounded turret on the Mark IA, it was still only intended for one man, but, in addition to the Vickers machine-gun mounting at the front, it had sufficient space in the rear for a No. 1 wireless set, assuming one was available.

Another improvement to the Mark II was less obvious. This was the adoption of Cemented Tank Armour, or CTA plate, which in modern terms would be described

A column of light tanks moving carefully through a country town. The leading tank is a Vickers-Armstrongs-built Light Tank Mark IIB, identified by the petrol filler cap on the side, although in this case the registration number gives it away.





Hopefully this is a joke. One reluctant mule is harnessed to an Indian Pattern Light Tank Mark IIB to help it over a rough bit of ground. In real life one mule would not be strong enough to move a light tank, not even with two men pushing. Note the turret cupola, characteristic of light tanks in India.

as face-hardened armour, reckoned to be about 20 per cent more effective in terms of resistance to armour-piercing projectiles than conventional homogeneous armour. This meant that thinner plates could be used, which in turn offered a reduction in overall weight. CTA plate was adopted for all future types of light tank up to the Mark VI.

In mechanical terms the Mark II followed previous practice, although it was appreciated that something better was required. Thus the engine, a six-cylinder, water-cooled Meadows type EPC, was installed, offset to the right, driving through a two-speed and reverse primary gearbox via a two-speed epicyclic box to the front-mounted driving axle. There was a further reduction at each end of the driving axle and simple clutch-and-brake steering, operated by a tiller bar. This did not prove popular with drivers, since it could result in the worrying experience known as reverse steering. As a result it was decided to replace the original transmission with a new one incorporating the Wilson pre-selective gearbox and twin lever steering.

In order to fulfil the requirement that each of three Royal Tank Corps battalions, described as mixed battalions, should include 22 light tanks, the War Office agreed to order a further 50 on top of the 16 already specified. Production would be shared between the Royal Ordnance Factory, which would build 29 designated as Mark IIA, while Vickers-Armstrongs received a contract for 21 identified as Mark IIB. It is interesting to note that this total of 66 tanks of the Light Tank Mark II type was exactly what was required to complete the three mixed battalions. There was no provision at all for spare or reserve tanks. Both Marks IIA and IIB featured the new transmission from the outset.

It is virtually impossible to distinguish a Mark IIA from a Mark IIB. A filler cap on the left side of the IIB is a clue, but only if you can see the left side, otherwise the WD or registration number is the only indication. A Mark IIA had two fuel tanks whereas a Mark IIB had one, albeit of a greater capacity than the two in the Mark IIA. However, it was possible to distinguish between the original Mark II and its successors. Marks IIA and IIB had an armoured flap at the front of the hull, to the right of the driver, and on both sides of the turret a protected ventilation louvre ran along the top edge, which shows up as a strip of armour standing proud from the turret on each side.

The fact that 66 of these tanks had been built with the intention of completing three Royal Tank Corps battalions with their complement of light tanks may not have been honoured to the full, since some of them were clearly earmarked for experimental purposes. In 1932, when the need for more power was deemed desirable, the Meadows engines were removed and replaced by the Rolls-Royce 20/25bhp type.

Trials on the Indian Frontier with the Mark IA light tanks as reported in the *Royal Tank Corps Journal* seemed very favourable. A series of articles by three RTC officers, Colonel Studd, Major Kenchington and Major Birks had made the case for light tanks in India instead of armoured cars, on the grounds that they could travel more widely in that region, and the authorities seemed disposed to agree. A number of armoured-car companies were redesignated light-tank ones and equipped with the

Light Tank Mark IIB Indian Pattern, a modified version of the British type. Although somewhat light on armour, since it was only likely to come under rifle fire, the Mark IIB had an extra stowage locker at the rear, a protected cupola for the commander on top of the turret and cooling louvres covering the engine compartment on the offside. The Indian light tanks had the same engine, transmission and suspension as their British counterparts, but did not go through the process of replacing the Meadows engine with the Rolls-Royce unit. Exactly how many were supplied is not clear, but it seems to have been for a minimum of three companies, which with 16 tanks apiece works out at 48 tanks, so the minimum figure must have been about 50. One entry in a Vickers-Armstrongs ledger quotes either 54 or 59, which is probably about right.

LIGHT TANK MARK III

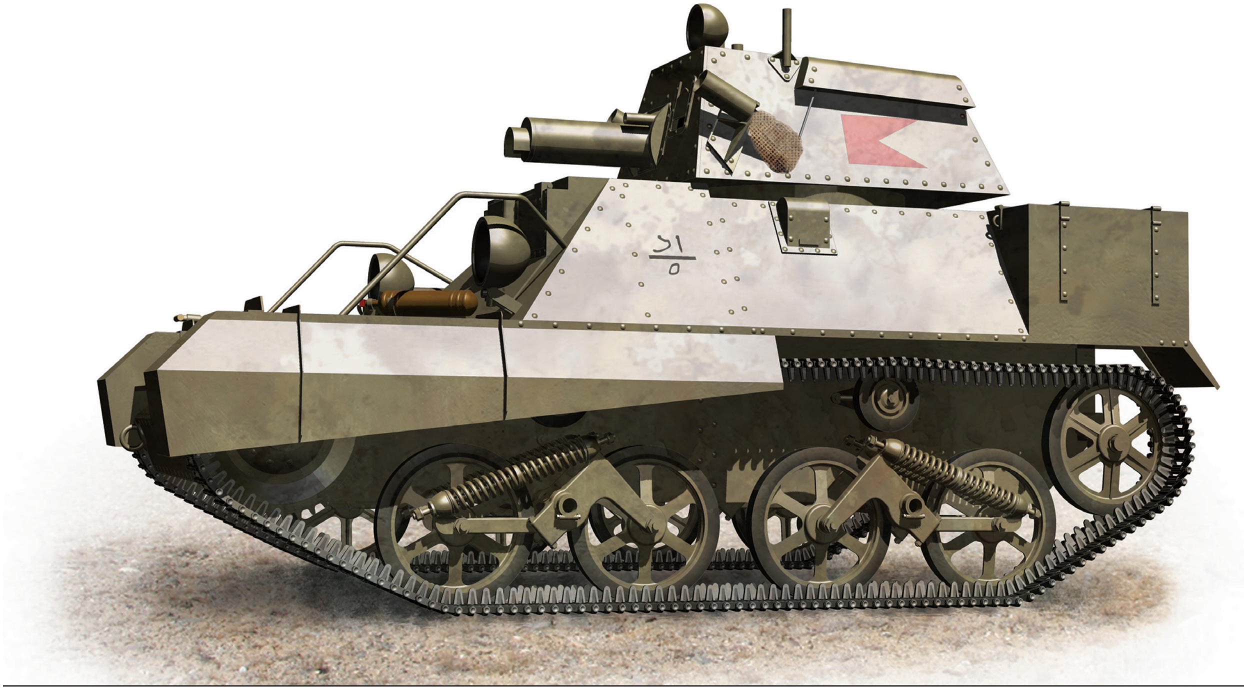
The Light Tank Mark III gets short shrift in most published works on tanks, as it was little more than a production version of the improved Light Tank Mark IIB, with the new suspension, Rolls-Royce engine and Wilson transmission. However, closer inspection shows an enlarged turret, modified hull shape and improved ventilation for the engine, and an alloy sub-frame to reduce weight. However, this was offset by slightly thicker armour, so it was in fact about 5 cwt heavier than the Mark IIB.

Production was shared between Vickers and Royal Ordnance, with a total of 42 tanks built, some of which reputedly carried the bigger .50in Vickers gun instead of the .303in. Nearly all of these tanks were shipped out to the Middle East in about 1935 to increase the strength of the 6th Battalion Royal Tank Corps. This unit was created in Egypt in 1932, unofficially at first, by the amalgamation of 3rd and 5th Armoured Car Companies, Royal Tank Corps. To begin with it was limited to two companies of rather tired medium tanks and Carden-Loyd Carriers. In the event, it was C Company that took 18 Light Tanks Mark III to Palestine in 1936. A few of these tanks were also operated by the Egyptian Army.

Yet that was not the end of the story of the Light Tank Mark III; its true moment of glory was still to come. In June 1940, 12 of these tanks, probably veterans of 6th Royal Tank Regiment, were sent from Egypt to Kenya and handed over to the South Africans, who operated them as No. 1 Light Tank Company. Despite the fact that they had only limited training, the South Africans kept most of these tanks in service for the next 12 months, and they seem to have made an effective contribution to every battle they took part in. Most of the time they were carried on improvised tank transporters, which the South Africans called portees. Although South African military historian Commandant Neil Orpen described them as ‘in appearance not unlike Bren-gun carriers fitted with turrets’, they were certainly better than nothing, and achieved results out of all proportion to their numbers or effectiveness. Yet the Rolls-Royce engine showed evidence of excessive wear when used in a tank, so for the future it was decided to revert to a Meadows unit.

LIGHT TANK MARK IV

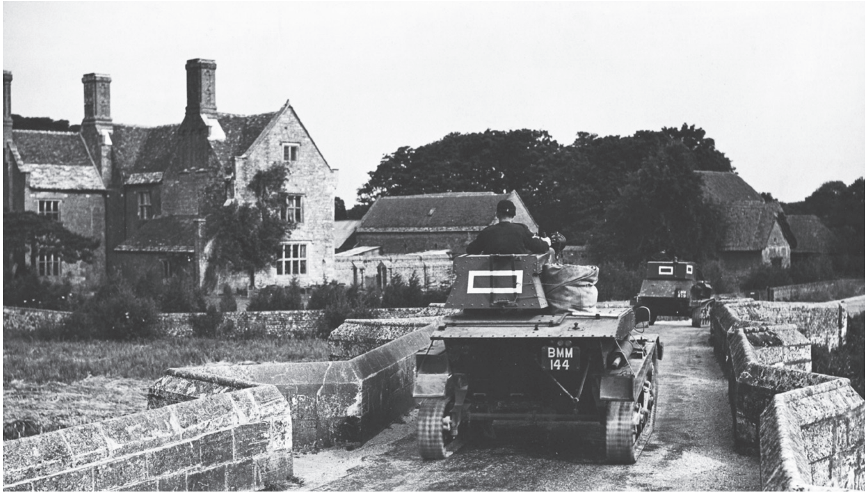
The appearance of the Mark IV Light Tank in 1934 introduced a striking change in basic design. A lot of somewhat extravagant claims were made in respect of the new tank, mostly concerned with the construction of the hull, although it is difficult to



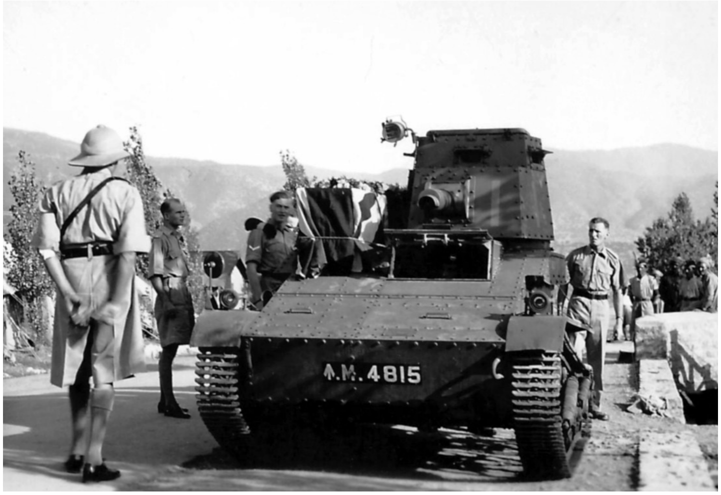
LIGHT TANK MARK III, EGYPTIAN ARMY

The Egyptian Army included a Light Tank Unit, which for a while was equipped with redundant British Light Tanks Mark III. It was extensively photographed for propaganda purposes early in the war, although the truth of the situation was somewhat different. Although it was under the command of senior British officers and reasonably well equipped with British weapons, the Egyptian Army was not comfortably disposed towards the British; it accepted joint responsibility for the defence of Egypt, without going to the lengths of declaring war, but was not entirely trusted by the British and was withdrawn from the front line when threatened. Relations between troops and their own Egyptian officers were not good.

The Light Tank Mark III dated from 1932 and was in essence an improved Mark II. Powered by a Rolls-Royce engine and running on the later pattern Horstmann suspension, it was another two-man tank armed with a single Vickers machine gun and covered by slightly thicker armour. In pre-war years it was probably the dominant British light tank in the Middle East. It was used by 6th Battalion, Royal Tank Corps in Palestine in 1936 and later by South African troops in East Africa, although it was not really suitable for a modern conflict. In Egyptian service the light tanks were painted a light stone colour overall, with limited Egyptian markings. (Art by Henry Morshead, © Osprey Publishing)



A Light Tank Mark IV following a Light Tank Mark VI over Wool Bridge near Bovington. The house on the left is Woolbridge Manor. This shows, better than a front view, how the turret was offset to the left, although the big bundle of canvas alongside the turret would make it difficult to rotate.



An Indian Pattern Light Tank Mark IVA carries a flag-draped coffin during the funeral of Private Charles Floyd of 9th Light Tank Company, who died in 1937 from wounds received on the North-West Frontier. There was plenty of room alongside the turret to stow a coffin.

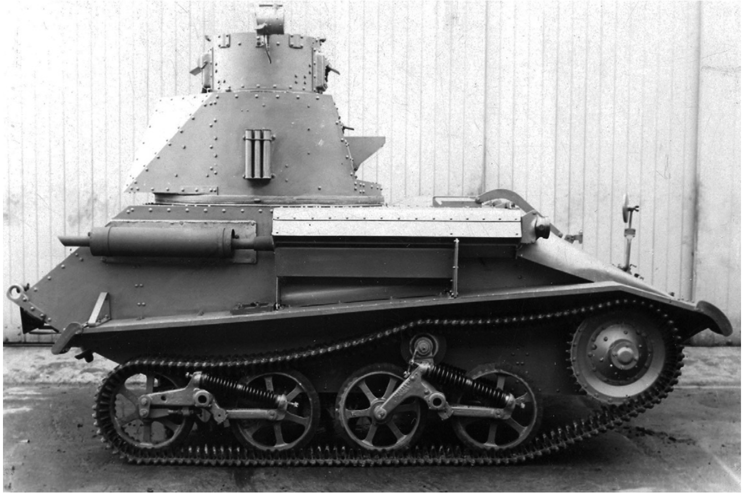
confirm many of these. Even so it was an unusual design, unlikely to be mistaken for anything else. It was the last of the two-man light tanks to be built to War Office requirements, but it is not entirely clear what the designers were aiming for. At first sight it looks inherently unstable, with a tall hull and short track base. However, on closer examination these prove to be illusions. Much was made of the inherent strength of the hull, which in profile looks like a squashed parallelogram, interrupted only by the driver's hatch and the turret perched on top. Maximum armour thickness was 12mm and the overall weight was 4⅓ tons. Even so, it is the suspension that creates the illusion: it looks shorter than on previous tanks, because it lacks the rear idler wheel, which set a pattern for subsequent models. In terms of track length in contact with the ground there is not a great deal in it. In respect of overall height, it was lower than the later three-man types and only marginally taller than the Light Tank Mark II.

One change that looks like a reversion to earlier days was the return to the Meadows engine, the straight-six type ESTE that developed just under 90bhp, giving the tank a top speed of 36mph. This made it the fastest of them all, and speed was going to be a vital factor in the future. The engine was located on the right of the hull with the driver sitting alongside it, while the turret was situated directly behind him, giving the tank a decidedly lopsided look, and making it very definitely left-hand drive. The Wilson pre-selector transmission was dropped in favour of a Vickers-Armstrongs five-speed crash type, and lever-operated clutch-and-brake steering. One can only imagine that this was a general return to simpler, more rugged systems that did not require so much careful attention and maintenance.

Nothing shows more how production of the Light Tank Mark IV was squeezed by previous and future models than the way its manufacture was limited to 28 tanks, 14 each from Vickers-Armstrongs and the Royal Ordnance Factory. This meant that the tank was never seen operating at battalion level. On the other hand, they turned up everywhere, rarely in more than twos and threes, but always very distinctive on account of their shape.

Although the two prototypes were designated as experimental Indian Pattern, they never went to India, and instead became prototypes of the Light Tank Mark IV. A third prototype, lacking any British designation, was delivered to India in 1933, where it was tested by the local authorities.

The Indian type can be easily identified by an upward extension of the turret, with a series of lookout flaps all around that served as a sort of cupola, something that was characteristic of tanks built for service in India. The armour on the Indian version of the Light Tank Mark IV was thinner, and the tank was known in India as the Light Tank Mark IVA. However, the tank did not appear in very large numbers because, as in Britain, a new model was in the offing. An original ledger gives a total of 29 and the date as March 1934.



The special Light Tank Mark V built for India, of which there was only one. The machine guns have yet to be fitted, but the enormous cupola is readily visible with spotlight attached. The tubes on the side of the turret are for holding signal flags, but how anyone was supposed to reach them is not clear.

LIGHT TANK MARK V

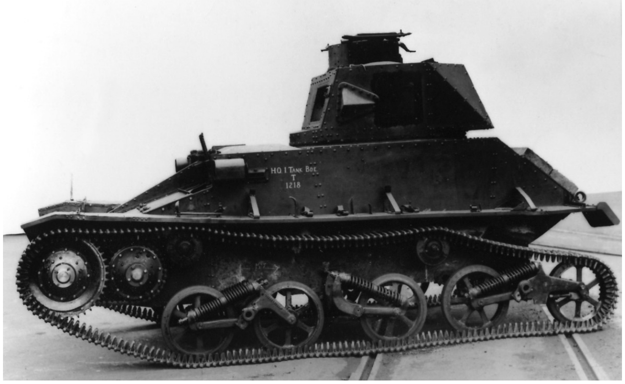
One issue that had already arisen, and been tackled at various levels, was the growing awareness that a two-man tank was inadequate, certainly when it came to the role of the tank commander, who was also the gunner and wireless operator, as well as having a host of other, less tangible duties. Two Royal Tank Corps officers tackled the matter in a magazine article with the eye-catching title of 'The two-and-a-half-man light tank', although more realistically it soon became evident that anything less than a three-man tank would not be effective. As a result, the next two prototypes (L3E1 and L3E2) mounted larger turrets that could accommodate an extra man, and advantage was taken of the additional space to fit a second machine gun. This was a .50in Vickers gun, which at that time qualified as an anti-tank weapon.

The first prototype, L3E1, was fitted with a full-width turret, squared off at the back and flat on top, with a Bishop's Mitre cupola situated offset to the right on top. There is no evidence of a second hatch, and if the commander monopolised the cupola the gunner still had enough to do managing the guns. By 1939 the turret had been removed and the tank became the carrier/launcher vehicle for the prototype scissors bridge designed by a Royal Engineer officer and staff from the Experimental Bridging Establishment at Christchurch.

The second prototype, L3E2, had a different turret design, sloped at the back and with a drum-shaped cupola for the commander on the right. Alongside it on the left was a simple hatch for the third man so he could at least poke his head out and see what was going on. The turret, being larger and heavier than on the two-man tanks, was fitted with a crowded ball race to make it easier to traverse, and was secured by six brackets to prevent it from jumping off. The turret also included a rotating portion

Three Mark V tanks of the 9th Queen's Royal Lancers (the queen in question being Queen Adelaide, wife of King William IV). The tanks look suitably immaculate and feature the regimental badge on the turret, but note how the turret slopes at the back, limiting interior space.

of the floor, which carried wireless batteries, ammunition containers and a seat for the gunner, attached to a stay, while the commander was provided with a rotating cupola so that he could survey the battlefield. Geared traverse was also available, as it had been for all the earlier light tanks, although one revolution of the hand wheel shifted the turret by only three degrees. In this form it was clearly similar to the production tank, 22 of which were built, sufficient for one mixed tank battalion. Sources vary – some say that a dozen tanks were first delivered to 1st Tank Brigade and that technical experts from Vickers-Armstrongs accompanied the tanks and worked with the crews to remedy any faults quickly. However, other sources do not mention this and refer to nine tanks, some of which were returned to the manufacturers for improvement, while others were shared out between various establishments for trials. There may be some truth in both accounts.



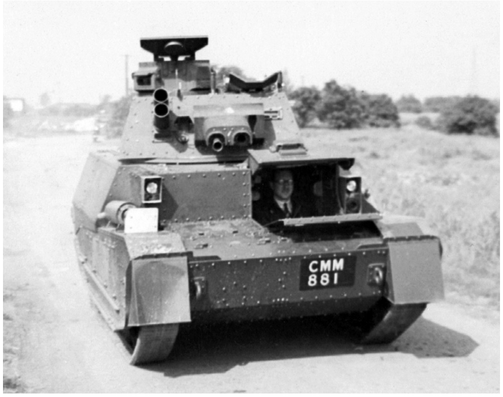
The stretched Mark V with the extra wheel station and the drive sprocket shifted forwards, but without armament. According to the legend on the side, this peculiar tank also served with HQ 1st Tank Brigade.

Another feature seen on some, but not all, production tanks was a pair of armoured air-intake louvres installed on top of the hinged engine cover plate. These may have been a later addition. In any case, it is clear from photographs that most of these tanks were initially distributed to various newly mechanised cavalry regiments to help with training, so the chances that all 22 ended up with a mixed battalion seems highly unlikely. One Light Tank Mark V was modified by inserting an extra wheel station and having the drive sprocket moved forward. The idea seems to have been to extend the track base and improve stability in order to make it a better gun platform, but it was never developed.

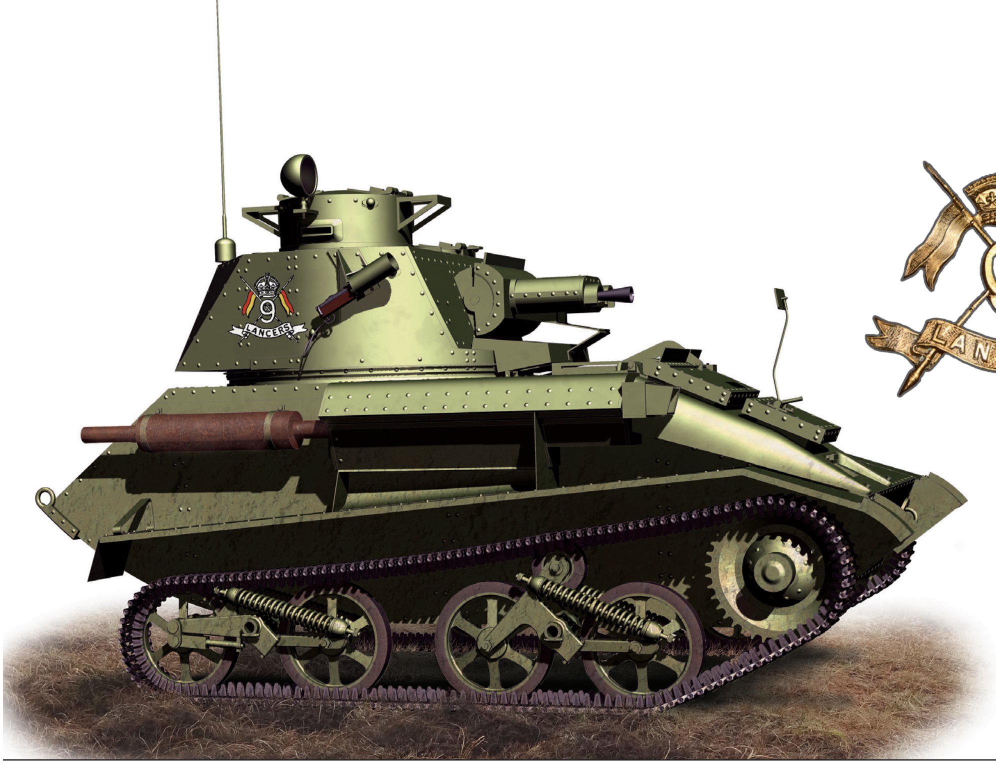
L4E1: THE SUPERINTENDENT OF DESIGN'S TANK

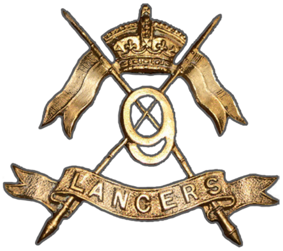
As we have seen, the design department at Woolwich Arsenal had been involved with the detailed design and manufacture of some light tanks, but the basic features in every version were the responsibility of Vickers-Armstrongs, harking right back to the take-over of the Carden-Loyd Company in 1928.

It therefore comes as quite a surprise to find the design of a new light tank awarded to the superintendent of design at Woolwich in 1936, and that it should have been a three-man machine, which was then something of a novelty. One is forced to ask whether the War Office was giving Royal Ordnance an opportunity, or whether it was hoping to provoke Vickers-Armstrongs by presenting them with a rival. Despite many claims made for it in terms of originality and fighting ability, the basic design was little different from the Light Tank Mark V. New features included a rear escape door for the crew, an extended track base, an extra road wheel on each side and the reintroduction of an adjustable rear idler and armoured skirting plates covering the suspension. As a result the new tank turned out



The Royal Ordnance prototype L4E1 works up to a reasonable speed with a civilian driver. Even so it looks well protected, probably too well for its size, and although it served briefly with 1st Tank Brigade the type was never taken into service.





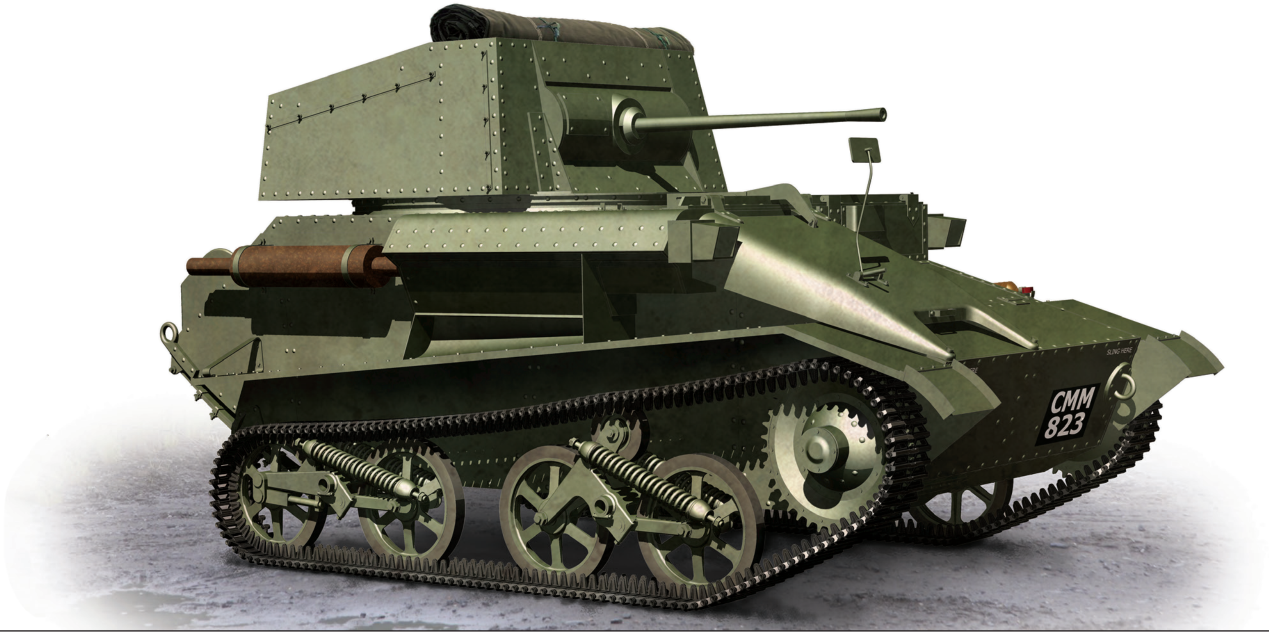
LIGHT TANK MARK V, 9th QUEEN'S ROYAL LANCERS

The Light Tank Mark V was the first three-man light tank to see service with the British Army, appearing in 1934. Production was limited, since it was overshadowed by the improved Light Tank Mark VI. It was powered by a six-cylinder Meadows engine and armed with a pair of Vickers machine guns, one of .303 calibre alongside a heavier weapon of .50, which at the time was regarded as an effective anti-tank weapon for use against lighter vehicles. In practice, as it turned out, this gun was not even good enough to penetrate the armour of an enemy light tank.

The 9th Lancers mechanized shortly before the war, in 1937, disposing of most of their horses and adopting armoured vehicles instead. For the younger soldiers this was no hardship at all, since they tended to find horses tiresome, but to the older soldiers, particularly the officers, it was a considerable wrench, since it required the rapid adoption of new skills. In fact most cavalry regiments went first into armoured cars, although the 9th Lancers seem to have specialized in tracked vehicles and field-tested many interesting prototypes. In typical cavalry fashion their vehicles were maintained to a very high standard, finished in gloss paint, which was quite unsuitable for war, with regimental insignia emblazoned on both sides of the turret. All armoured regiments were incorporated into the Royal Armoured Corps in 1939. (Art by Henry Morshead, © Osprey Publishing)

somewhat heavier. Although it served with 1st Tank Brigade in 1937 and was reported on favourably by the Mechanisation Board, it was never developed.

Mention should also be made of a series of light tanks built by Vickers-Armstrongs with commercial sales in mind. Since, by agreement, Vickers-Armstrongs was not permitted to use any features developed by the War Office authorities, these tanks were all slightly different from those issued to the British Army. Outwardly this seems to have applied only to the shape of the turret, but since matters such as armament and the type of radio fitted were left to the customer, this also resulted in observable differences between tanks of the same type. Most of the countries that were customers for this type of tank were those that had no viable tank industry of their own, and Vickers-Armstrongs were competing with French, Italian and Czechoslovakian builders as well as Marmon-Herrington in the United States. Nevertheless, Britain's perceived pre-eminence as the first builder of tanks, along with the supposed expertise of their workforce, still counted for a lot. Even so, it has to be said that the majority of light tanks supplied by Vickers-Armstrongs were no better armed or armoured



LIGHT TANK MARK VI, 2-PDR TANK DESTROYER

Good as it was mechanically, and available in vast numbers, the Light Tank Mark VI had one serious failing. It was not provided with an armament powerful enough to disable, let alone destroy an enemy tank – not even an enemy light tank, its own contemporary. Thus when it appeared in prototype form in 1935 the special version of the Light Mark VI, fitted with a 2-pdr (40mm) anti-tank gun in an open-top turret, was seen as a very useful piece of equipment. It went to MWEE in about 1938 and was extensively field tested by the 9th Royal Lancers, but no production orders followed. It remained a unique piece of equipment.

Judging by appearances, since photographs are all we have to go on, the design seems to be quite well balanced. The turret mounting the 2-pdr gun was undoubtedly heavier than the normal machine-gun turret fitted to the tank, despite being open at the top, but it should have been possible to strengthen the rearmost suspension unit if required. As it was, the design was rejected, possibly because it did not accord with British ideas on armoured reconnaissance at the time; it must be said that enemy light tanks were no better off in this respect, although they were somewhat better armoured. Even so, it remains a most interesting and potentially useful prototype that could have proven very effective in the not-too-distant future. (Art by Henry Morshead, © Osprey Publishing)

than those used by British forces, and as such could not really be described as tanks capable of going into action against other tanks.

THE LIGHT TANK MARK VI SERIES

It is tempting to see the Light Tank Mark VI as a version of the Light Tank Mark V with a new turret. It is probably more correct to say that they were all part of an evolutionary process. There were no prototypes as such this time, but from the first batch of 41 no less than ten went to MWEE for evaluation, and one of those was a very interesting tank. Tank T1667 was described as being fitted with a 2-pdr anti-tank turret. This was a fairly large turret, open at the top and fitted with a 40mm anti-tank gun. It was tested at MWEE and presumably rejected, although on what grounds is not known. It was a pity, on the face of it, because the time was coming when a light tank fitted with such a weapon would be very useful indeed. The other nine tanks sent to MWEE, and indeed the remaining 21 tanks in the batch, all appear to have been perfectly normal.

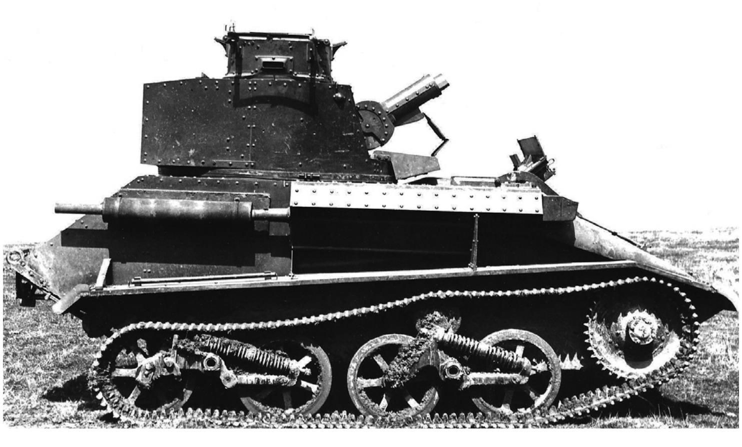
They had the same hull and suspension as the Light Tank Mark V, albeit with maximum armour thickness increased to 14mm and with the return rollers attached to the foremost bogie. This arrangement seems to have been regarded as being responsible for an epidemic of track shedding, which was cured in later versions. The same Meadows engine and transmission and the same cooling arrangements were also employed. However, the spacing of the suspension units was altered slightly to give a better ride across country. The turret was different: inside it was provided with a fully rotating floor that carried the gunner and commander around with it, and externally it was extended and squared off at the back, not unlike the turret of L3E1 in this respect, in order to provide room for a No. 7 wireless set. This gave rise to what might have been an awkward situation, which had first surfaced in the case of the Light Tank Mark V. The Royal Tank Corps wanted to introduce the position of gunner/operator, which had not existed before. It wanted the gunner to also be the wireless operator, rather than the commander. It was necessary to negotiate with the trade unions at the various factories before this change could be permitted. These tanks were also seen with two 4in smoke-grenade dischargers, one fitted on either side of the turret, but since these were also found on the Light Tank Mark V tanks, they may have been a later fitting. The overall weight had increased to around five tons, but this had little effect on the performance.

Three more batches of the Light Tank Mark VI followed for small numbers of tanks, two from Vickers-Armstrongs, but the third from the North British Locomotive Company in Glasgow. This was part of government policy to expand tank production into the private sector with war imminent, so that other engineering concerns would gain experience of tank production. Individual tanks were sent out to the Western Desert for evaluation under extreme conditions, and one, fully equipped with sand shields, was even photographed at Siwa Oasis, deep in the Egyptian Desert, which has legendary associations with the Oracle of Amon.

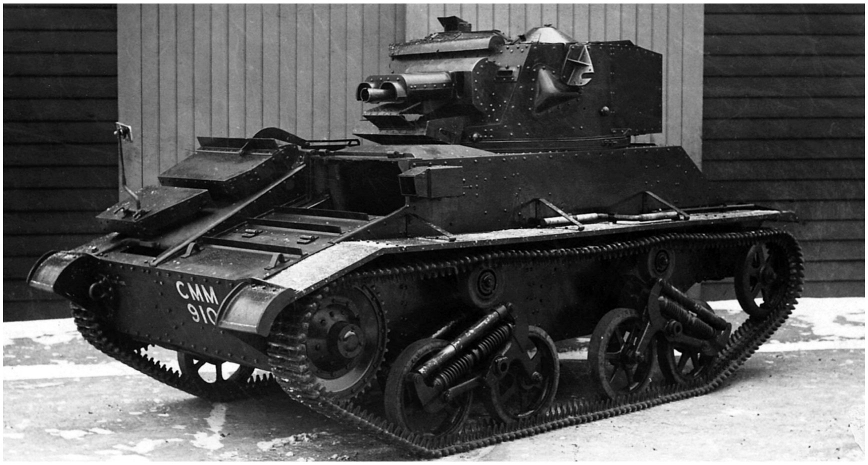
The next batch of tanks was classified Mark VIA. They were built in three batches amounting to 110 tanks in all, with one contract being awarded to the Royal Ordnance Factory. Three went to MWEE for evaluation while ten were sold to Australia.

Distinctive features of the Light Tank Mark VIA were that the return roller was removed from the front bogie on each side and attached directly to the hull, and the commander's cupola was made more angular, becoming essentially octagonal in shape, with glazed lookout ports at the front. An improved version of the Meadows six-cylinder engine, type ESTB, was also fitted, although rated at the same horsepower.

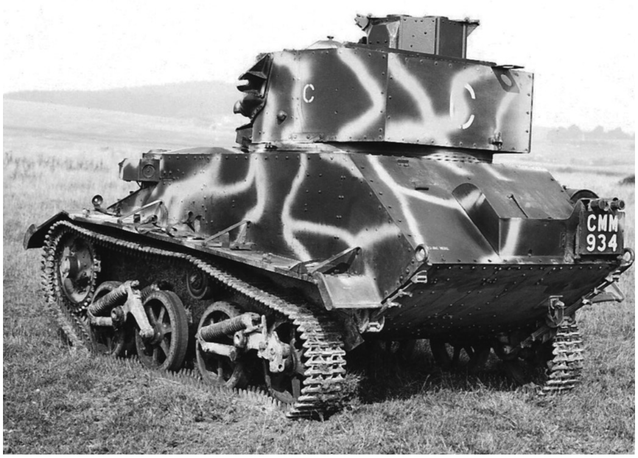
The next batch, the Mark VIB, was produced in substantial numbers and may be taken as the definitive version of the tank, though not the final one. In terms of appearance it retained the return roller on the hull side, was fitted with a drum-shaped cupola



The first of the Mark VI tanks, T1641, with its guns at maximum elevation. Note how the mud-encrusted return roller is attached to the leading bogie. This is one of the few really reliable identification features of this type, although the absence of raised cooling panels at the front is also an indicator.



A Light Tank Mark VIA fitted with the extended suspension intended to provide greater stability and a better gun platform. An extra double bogie has been fitted, reversed, at the back, and both bogies have additional shock absorbers and their own return roller. The turret has also been modified: the cupola has gone and been replaced by a low hatch complete with a periscope.

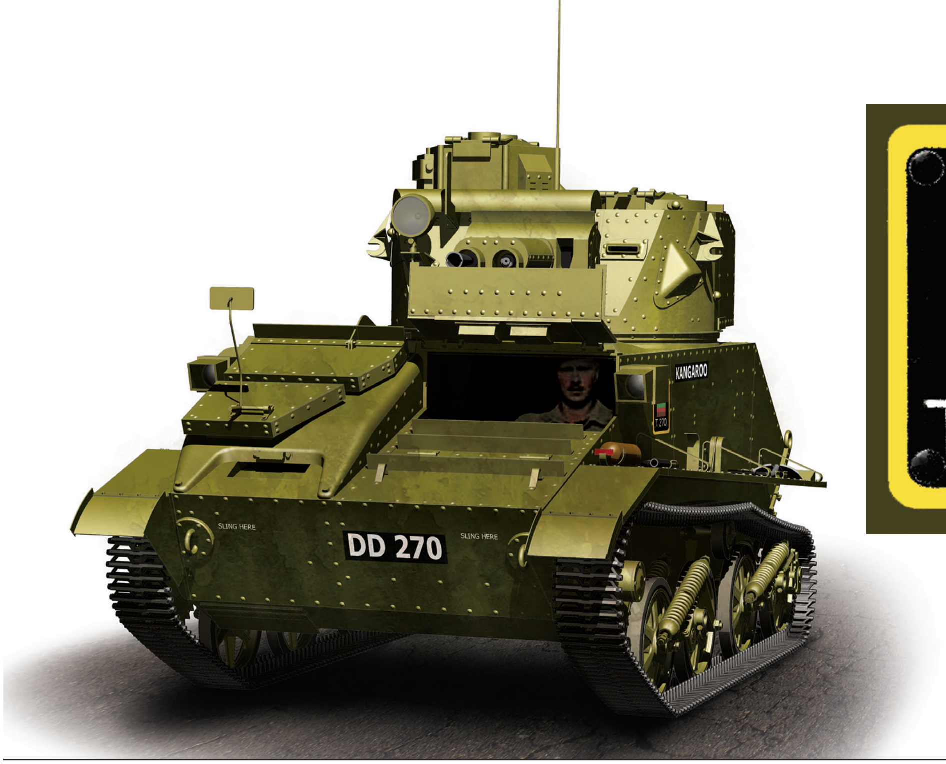


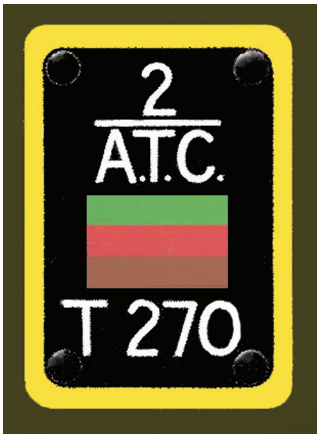
A Light Tank Mark VIA, finished in a most unusual camouflage scheme. The angular cupola is a clue to its identity, but most positive of all is the fact that the track return roller has been moved further back and is now fitted directly to the side of the hull.

like the Mark VI, but this time with lookout windows, and had only one armoured louvre, the upper one, on the engine cover at the front. In other respects it was the same as the preceding models. Nearly 1,000 of these tanks were produced by a range of firms including the Vulcan Foundry, John Fowler and Company of Leeds, Ruston and Hornsby, Armstrong-Whitworth, North British Locomotive and Vickers-Armstrongs. In addition to seven supplied to Canada, some were sent to Egypt and Turkey and one to Iraq.

The Indian Pattern Light Tank Mark VIB, a special version of the Light Tank Mark VI, was prepared for service in India. A contemporary ledger gives the total delivered as 93 with the date as 24 August 1936, which ties in closely with general production of the type, but clashes with another claim quoted below. The tanks appear to have been identical to the British model, except for the fact that on the Indian Pattern no cupola was fitted to the turret. It is not entirely clear why this was so, as hitherto a cupola was considered essential for light tanks in India, but now for the first time this fixture was no longer considered necessary, and instead the commander was provided with a periscope in his hatch. To begin with these tanks were issued to British light tank companies in India, the Royal Tank Corps formations that had grown out of earlier armoured-car companies. However, when these formations were disbanded just before World War II the tanks were passed on to newly mechanised regiments of the Indian Cavalry and to British Cavalry regiments in India, such as the 3rd Carabineers and the 14th/20th Hussars. Even so, there were never sufficient light tanks to go around.

Indian Pattern light tanks accompanied a Royal Armoured Corps regiment to Persia early in World War II. They were used briefly against Japanese forces in Hong Kong and a few seem to have turned up in the Western Desert. Where these latter ones came from is difficult to determine. According to J.D. Scott's history of Vickers, published in 1962, 'in 1938 Elswick completed the order for light tanks Mark VIB



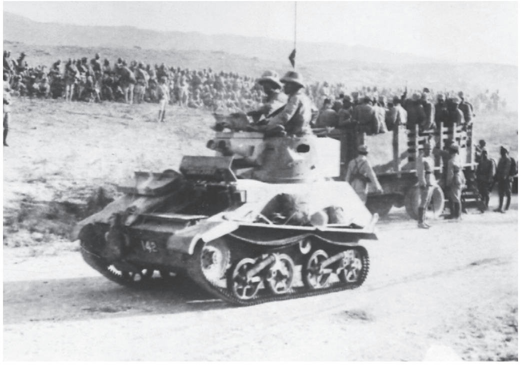


LIGHT TANK MARK VIA, 2nd LIGHT TANK COMPANY, AUSTRALIAN TANK CORPS, MELBOURNE

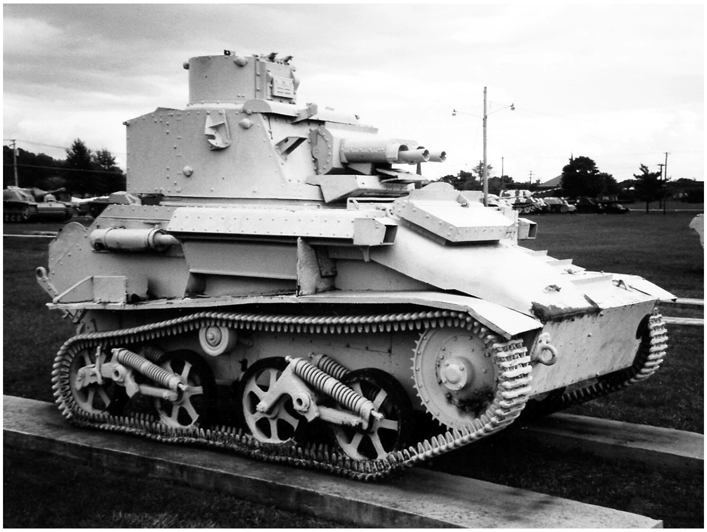
Australia took delivery of ten Light Tanks Mark VIA from Britain in 1937. They were a batch built initially for the British Army, so there were no concessions in the design for the hotter climate. Five each were allocated to the 1st Light Tank Company in New South Wales and to the 2nd Light Tank Company in Victoria. Since these – along with four old and obsolete medium tanks – represented all the tanks in Australia at the time, they were almost worked into the ground when Australia mobilised in 1939. Even so, they were never used in action; Australian armoured regiments were issued with tanks, such as were available, when they went abroad.

The distinguishing features of the Mark VIA are the shape of the cupola and the double set of armoured ventilation louvres on the sloping engine cover at the front. This view is taken from a photograph of these tanks on parade in Melbourne; notice how, when the driver has opened up the front panels and his visor, the upper section almost masks the two machine guns in the turret. This is not as bad as it seems, since in action, when the guns are needed, these panels would be closed down. On each side of the turret there are metal brackets with slots in. These would normally support the smoke projector dischargers, although these were not fitted when the photograph was taken. (Art by Henry Morshead, © Osprey Publishing)

for India', so it seems the chances of any remaining in Britain were slim. Even so, one source suggests that some Light Tanks Mark VIB built in Britain, the final batch as it were, had the same modification: the removal of the cupola and its replacement by a second flush hatch. If that is true then such tanks, seen in the desert, might easily have be mistaken for the Indian version. However, Lieutenant-Colonel L.B. Oatts' history of the 14th/20th Hussars states that 'any [tanks] in India that were in good condition were liable to be called in and shipped off to the Middle East'. It is also important to



An Indian Pattern Light Tank Mark VIB, easily identified by the lack of a turret cupola, photographed in Persia (now Iran) in October 1941. It was probably in service with the 14th/20th Hussars. By the time this photograph was taken the Shah of Iran had agreed to an armistice.



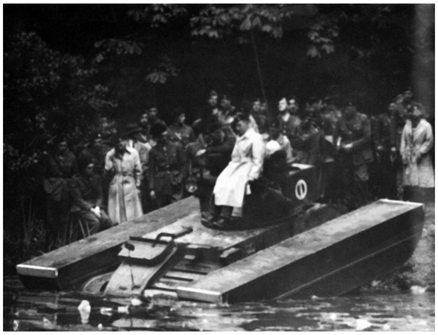
A Light Tank Mark VIB, once used by the Canadian Army but latterly in the Ordnance Museum at Aberdeen Proving Ground in Maryland. It has since been removed for restoration. Features to note include the single ventilation panel over the engine, the drum-shaped cupola and the return roller bolted directly to the side of the hull.

point out that when the 14th/20th Hussars went to Iraq and later Persia in 1941 they were equipped with a mixture of Indian Pattern Mark VIB Light Tanks and carriers with which they fought a number of successful actions.

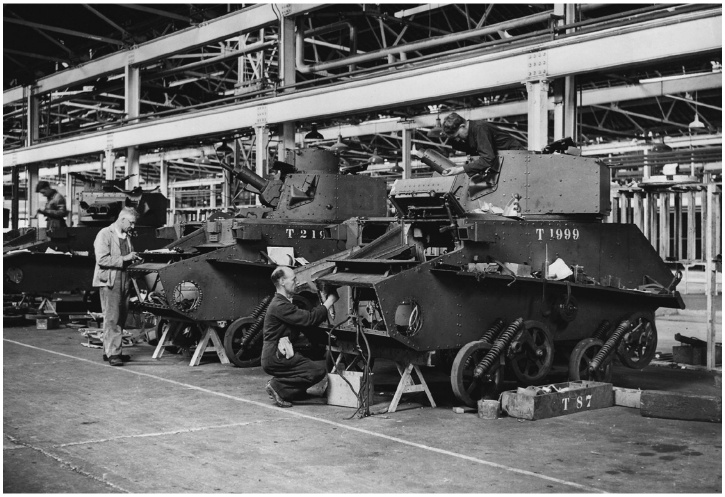
Shortly before the war the British Army decided to replace the water-cooled Vickers machine guns in armoured vehicles with air-cooled Czech-designed Besa machine guns. Naturally this was easier to achieve on some tanks than on others, and in the case of the Light Tank Mark VI it was relatively straightforward. The scheme was to replace the .303in Vickers with a 7.92mm Besa and the .50in Vickers by a long-barrelled 15mm weapon. This new mark of light tank, the Mark VIC, also had a turret fitted without the commander's cupola. In that respect it was like the Indian Pattern tanks and featured a periscope in one half of the commander's turret hatch, which replaced the cupola. The fact that the conversion was relatively simple seems to be indicated by an order placed with the Vulcan Foundry in November 1937 for Mark VIBs, the last 40 of which were completed as Mark VICs. Mark VIB tanks from this batch could well have been built without cupolas, although at present there is no proof of this.

At least one Light Tank Mark VI was tested on Mytchett Lake near Aldershot, equipped with a pair of floats designed by the Hungarian engineer Nicholas Straussler. Known as Series 2 floats, they were substantial pontoons attached to the sides of the tank to keep it buoyant in the water. However, since the tank relied on the action of its tracks to propel it, progress would have been dreadfully slow. The plan was to issue these floats to divisional cavalry regiments on the scale of six pairs per regiment. Some 120 pairs were made in all, but there is no evidence that they were ever used beyond this one time. The trouble was that the floats were quite bulky, so they would have to be transported in a lorry and attached to a tank near to the water's edge, which was an unnecessary complication.

From about the middle of 1940 onwards, up to 100 Light Tank Mark VIs were 're-manufactured' by the MG Car Company works at Abingdon in Oxfordshire. This seems to have involved stripping them down and fitting new parts where necessary. The firm undertook similar work on Matilda infantry tanks. However, a claim that the light tanks were all survivors of the 1st Armoured Division expedition to France cannot be correct, since we know that only six of these tanks ever returned to Britain. One of the most interesting and so far unexplained modifications applied to Light Tanks Mark VIB and VIC concerned the tracks. These appear to



A Mark VIB fitted with Straussler floats carefully enters the water on Mytchett Lake in Surrey. The floats were unwieldy things and a nuisance to transport, but they did keep the tank afloat, even if progress in the water was dismally slow since it relied on the action of the tracks.

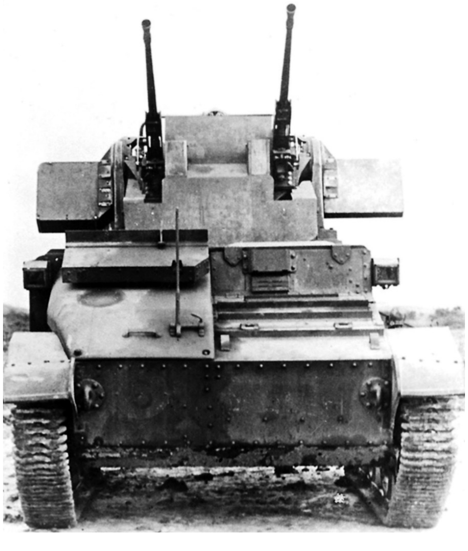


Light Tank Mark VIB Tanks undergo a full refurbishment inside the MG Cars works at Abingdon in Oxfordshire. MG undertook a number of these projects, including refurbishment of other tanks such as the A12 Matilda and full-scale conversions such as the Churchill AVRE and Centaur bulldozer.

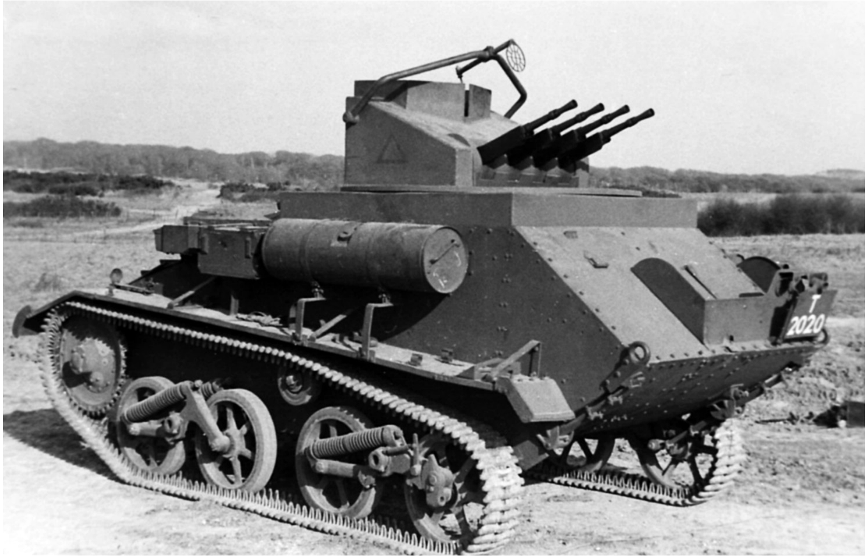
have been changed to a double-link pattern, rather like a scaled-down version of the tracks fitted to A13 cruiser tanks. They appear to have been a bit wider than the original single-link tracks and required new, twin-ring sprockets, which are very distinctive. There is no reason to suppose that this was connected in any way with the work done by MG Cars and may even date from an earlier date. It is also difficult to see what difference it made to the tanks, apart from adding to the weight, and it was definitely not applied to all of them; the project seems to have ended, as it had begun, with little explanation or fanfare.

The idea that specialist anti-aircraft tanks would be required seems to have stemmed from experience in France, where the German Stuka divebomber first revealed itself to be a terrifying, if not actually very effective, weapon. This prompted Major-General Vyvyan Pope, the Royal Armoured Corps representative to the British Expeditionary Force, to advocate the conversion of light tanks to an anti-aircraft role. One tank, usually identified as a Light Tank Mark V, but bearing all the hallmarks of a Light Tank Mark VIB, was converted at Lulworth Camp in Dorset to mount twin 15mm Besa machine guns in place of the turret. However, mainstream production began with the conversion of a number of Light Tanks Mark VIA into Light AA Tanks Mark I, which involved raising the superstructure and fitting a shallow turret armed with four Besa 7.92mm machine guns. This was followed by a Mark II version of the Light Tank Mark VIB, which had a taller turret with the same armament, but improved sighting arrangements. A total of 60 AA Tanks of both marks were produced and issued to headquarters squadrons of armoured regiments in Britain and the Middle East on the scale of four each. Whether they ever shot down an aeroplane is not so clear. The history of one of the newly created Royal Armoured Corps regiments, the 23rd Hussars, contains the following, telling phrase: 'we also received our first Anti-Aircraft Light Tank VIB which was not a popular vehicle.' This appears to have been towards the end of 1941.

The establishment of a light tank regiment early in the war is typified by the 4th Queen's Own Hussars in Egypt in 1940. They were equipped with 52 tanks and a dozen Daimler Dingo scout cars. Of



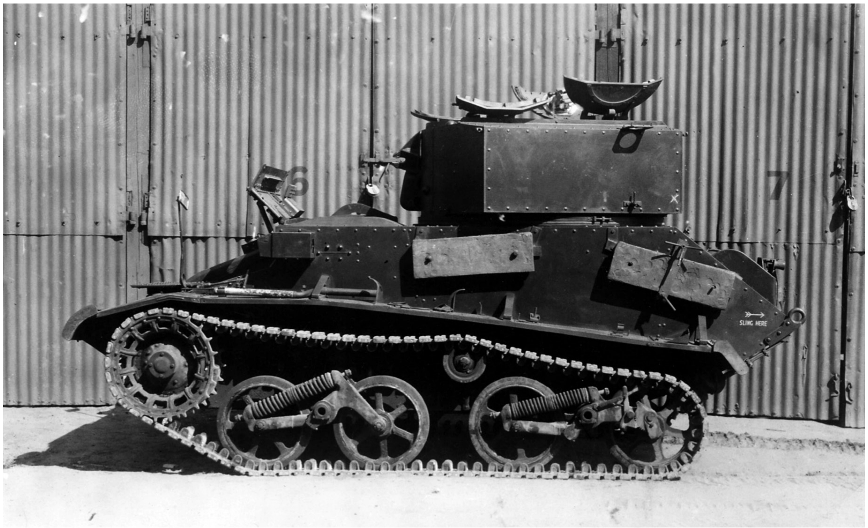
The first of the Light Tank Mark VI anti-aircraft tanks, mounting twin 15mm Besa guns, which was produced experimentally at the Lulworth Gunnery School. This picture has often been printed the wrong way around and is invariably identified as a Light Tank Mark V.



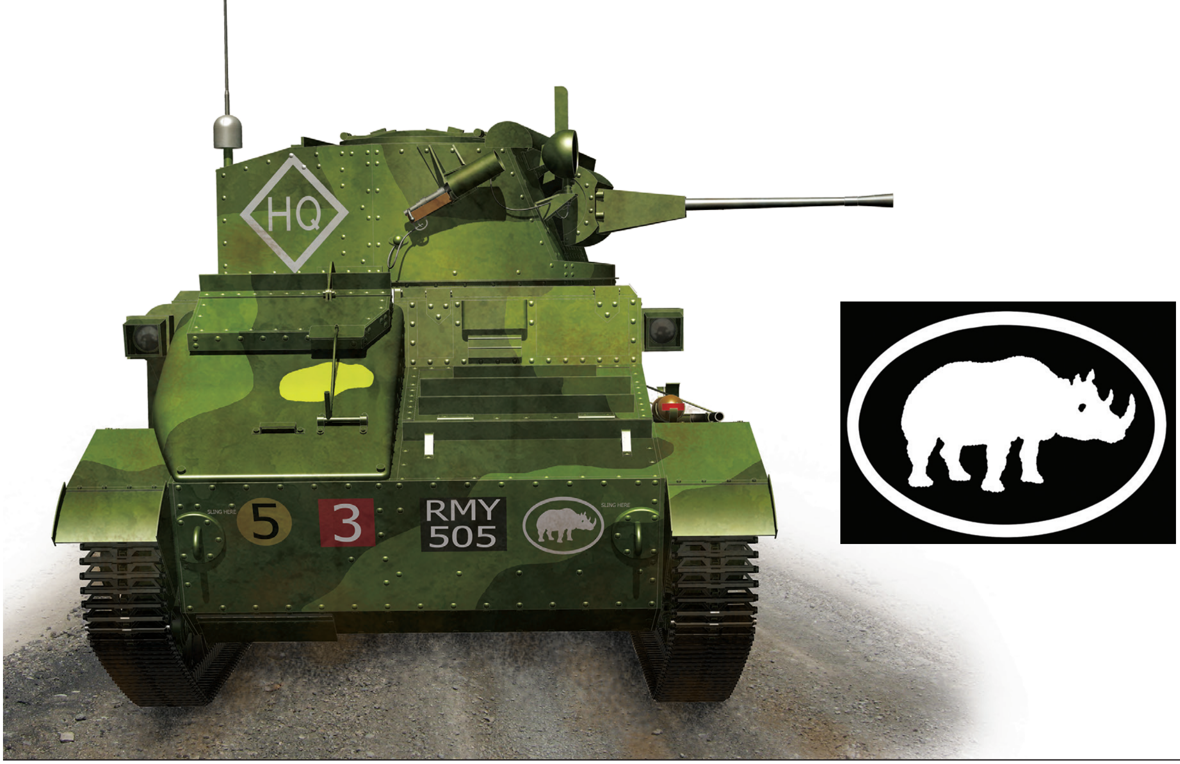
The final version of the Light Anti-Aircraft Tank was the Mark II, shown here with its gun turret reversed. The turret was armed with four 7.92mm Besa machine guns, but their limited range and restricted ammunition stowage meant that they were soon outclassed as aircraft flew faster and higher. They were converted from gun tanks, mainly the Light VIB version.

these, four light tanks were operated by regimental headquarters, while the three squadrons had 16 tanks each. In each squadron four tanks operated with squadron headquarters and three were issued to each of the four troops; the squadron also had two Dingo scout cars and two motorcycles, the remaining six Dingos being with regimental headquarters. When operating with a mixed formation that included Royal Artillery, at least one light tank was dedicated as an observation-post vehicle with a regimental driver and two Royal Artillery personnel in the turret. Mixed in with the fighting tanks, it was almost impossible to identify, and enabled the gunners to call down fire on any suitable target.

Incidentally, the 4th Hussars, who brought all their tanks out from Britain to Egypt, where they were unloaded at Port Said, say that before they could use them, all tanks had to be fitted with, among other things, sand filters, sun compasses, sand shields and an extra leaf to the springs of each tank. They are the only regiment to mention this. Wartime activities in the Western Desert are recorded later.



A Light Tank Mark VIC is shown here, although with the turret turned away from the camera it is not easy to tell. The main reason for selecting this picture is because it shows a light tank fitted with the heavier two-piece tracks and the slightly larger double drive sprocket at the front. An official explanation for this is still being sought.



LIGHT TANK MARK VIC, HQ 2ND ARMOURED BRIGADE, 1ST ARMOURED DIVISION, FRANCE 1940

The Light Tank Mark VIC was certainly the most distinctive of the tanks in the Light Mark VI series. This was due primarily to a change in armament, which had been decided on shortly before the war. In essence it meant that Besa air-cooled machine guns should replace Vickers water-cooled weapons on all armoured vehicles; the 7.92mm in place of the .303 and the 15mm instead of the .50. The 15mm, being that much longer than the .50 Vickers, was very distinctive. In practice, the whiplash action of the 15mm limited it to firing single shots. The Mark VIC could also be identified by the lack of a cupola on top of the turret, flush hatches being provided instead.

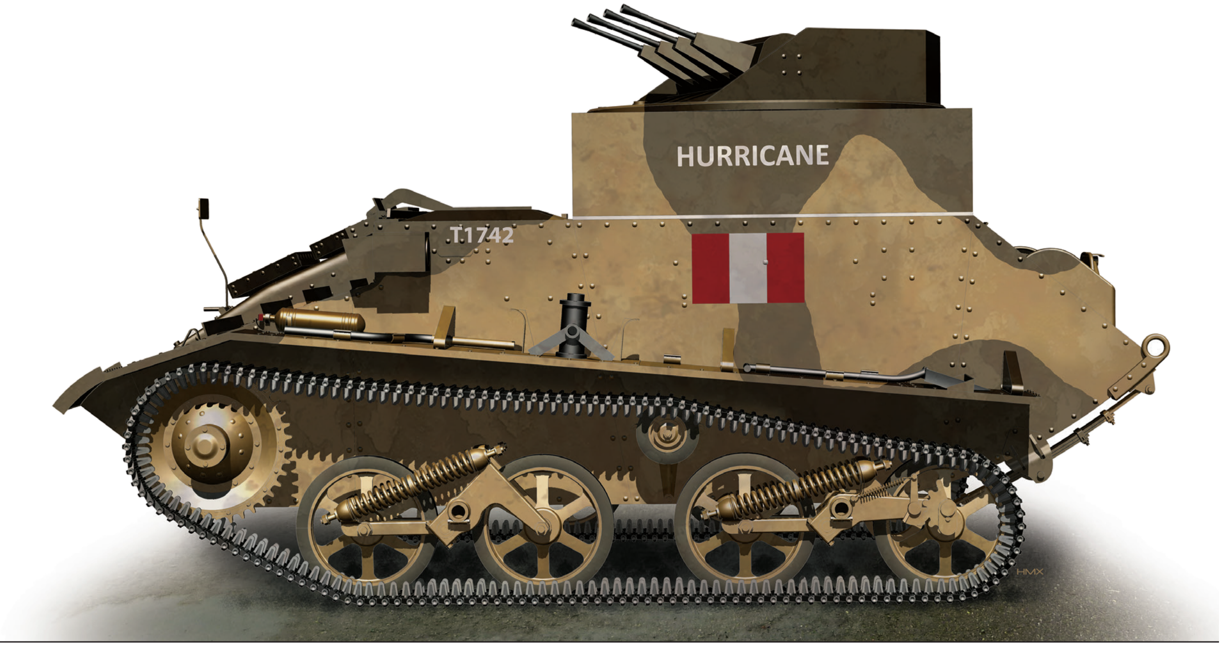
In theory it was agreed that regiments of British 1st Armoured Division should be equipped with the new Mark VIC tanks, while those of the divisional cavalry regiments should use the more common Mark VIB. In practice, it did not work out like that. There were simply not enough Mark VICs to go around, so it seems that in the main those regiments of 2nd Armoured Brigade – The Bays, 9th Lancers and 10th Hussars – were the only ones to be equipped with this new type of tank. (Art by Henry Morshead, © Osprey Publishing)

The dismal performance of these light tanks and their obvious unsuitability for modern warfare may have had an unfortunate effect upon the career of the next light tank to be produced by Vickers-Armstrongs. The Light Tank Mark VII, or Tetrarch, never managed to establish itself in that role and, although perceived as a light cruiser tank on account of its armament, it is really only famous for one event in World War II. On the evening of D-Day, 6 June 1944, eight Tetrarch light tanks of 6th Airborne Reconnaissance Regiment were landed by glider astride the river Orne; but this only reinforced the point that a light tank has no place on a modern battlefield.

ON ACTIVE SERVICE

THE BATTLE OF FRANCE

Among the first units of the Royal Armoured Corps to arrive in France were seven light armoured reconnaissance regiments, each of which on full establishment should have been equipped with 28 Light Tanks Mark VIB and 44 scout carriers. They may



LIGHT ANTI-AIRCRAFT TANK MARK I

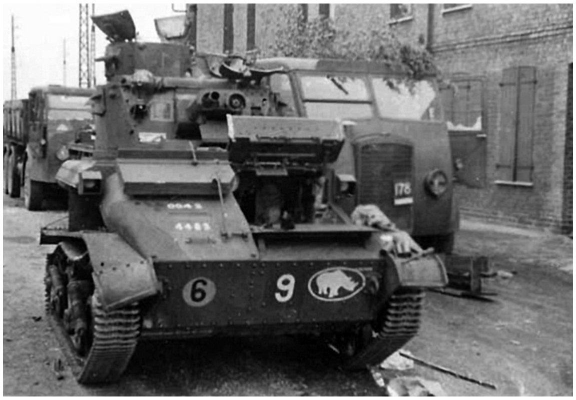
Mounting four 7.92mm Besa machine guns in a small turret the Light Anti-Aircraft Tank was the first response to the German dive-bomber attacks that were experienced in France in 1940. In practice, the relatively short range of the weapons and the difficulties of observing and tracking a fast-moving aircraft from a tank meant that it was almost impossible to shoot one down. There was only a limited amount of room in the turret, even without a tank commander, so a better-designed Mark II version soon appeared, although it was not much of an improvement.

Normal practice, when they were available, was to include four AA tanks with Regimental headquarters in an armoured regiment. But, the vehicles themselves were never popular, and when tests of the AA armament, which involved tracking a jeep with a can on the roof, proved too difficult, the entire scheme of basing AA vehicles on obsolete light tanks was abandoned. (Art by Henry Morshead, © Osprey Publishing)

have looked impressive to the British public, watching newsreels back home, but in reality they were almost completely useless, especially in view of what they were going to face in a few months' time. They were, in effect, the modern mechanised equivalent of the mounted divisional cavalry of earlier times; quite adequate for dealing with unarmoured troops but totally unsuitable for coping with enemy tanks.

Initially the armoured vehicles were shipped out and landed at Brest or St Nazaire in the west. Later it was found possible to go by the short sea route from Southampton. The story of all regiments is more or less the same, due to the nature of their equipment. The 15th/19th Hussars explain that they had two sets of tracks for their tanks: battle tracks, which were relatively new, and training tracks, which were nearly worn out but used where possible to save wear and tear on the battle tracks. The position may be summed up by an account in the history of the 5th Royal Inniskilling Dragoon Guards:

> A Squadron advanced to give battle but their (so-called) armour-piercing machine-guns had little effect on the German tanks and they were forced to give ground losing several vehicles and crews. It was becoming more obvious than ever how hopelessly inadequate were our fighting vehicles in the face of the opposition which now confronted us, German



A Light Tank Mark VIB of the 3rd Royal Tank Regiment photographed in Calais, probably after the Germans arrived. The divisional symbol of the British 1st Armoured Division is emblazoned on the front. It is very odd to see a Mark VIB here; one would expect it to be a Mark VIC. One wonders if this particular tank ever saw any action at all.

> Panzers. The Mark VIB was not only thinly armoured but its suspension was so bad that across country it did not even have the advantage of speed. In this mobile armoured warfare the unfortunate Bren Carrier troops were in an even worse position, equipped as they were to do no more than hold ground against infantry and light vehicles – very light vehicles at that. In the whole regiment we could muster no weapon which could be sure of penetrating a German Panzer, and had to rely, in the situation now facing us, on bluff and quick thinking.

Their part in the adventure ended at Dunkirk at the end of May and early June 1940.

It should also be mentioned that members of Brigade Headquarters, 2nd Light Reconnaissance Brigade, formed a unit known as Cook's Light Tanks, using tanks drawn from an ordnance depot, as part of the special defensive force created to protect British General Headquarters at Arras. The only exception to this part of the story was 1st Lothian and Border Yeomanry, which was attached to 51st Highland Division. The division had been stationed further south, ahead of the Maginot Line

A French soldier has mounted this Light Tank Mark VIB to talk to the crew. Just ahead of him is one of the two 4in smoke-grenade dischargers fitted on either side of the turret. The top half of the driver's visor is wide open, obscuring the view of the tray for catching spent cartridge cases fitted underneath the guns.

with the French. As the German attack developed, the division was withdrawn and, since there was no point in attempting to rejoin the original BEF, they were moved west to join British 1st Armoured Division west of the river Somme. By this time the German advance had really got into its stride, which the cruiser tanks of 1st Armoured Division were unable to halt. That being so, there was no hope at all that the light tanks of the Lothians would have any effect, and they were rapidly decimated, while the survivors fell back to St Valery and ultimately Le Havre.

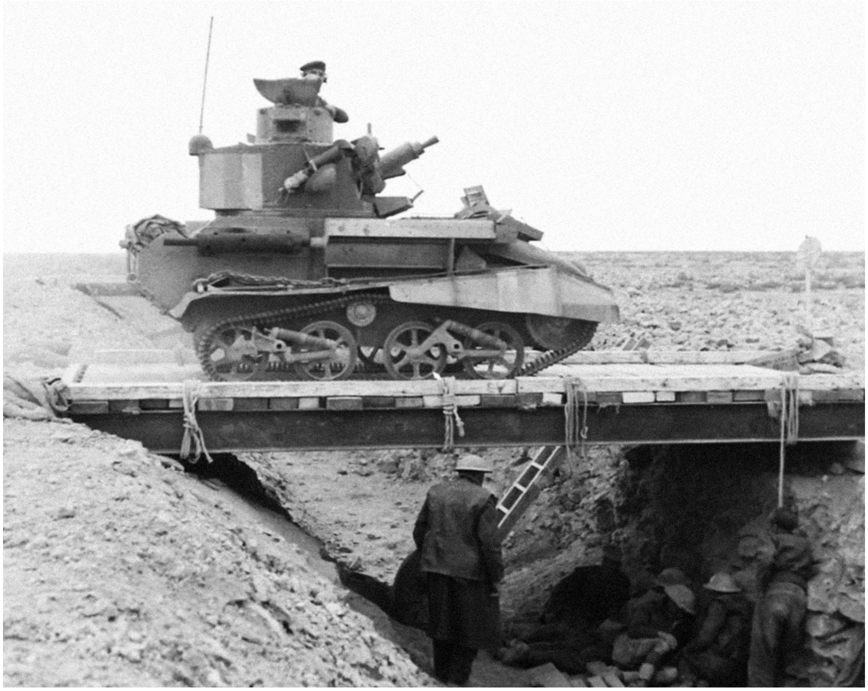
Meanwhile the two regiments of 1st Army Tank Brigade, 4th and 7th Royal Tank Regiments, equipped mostly with Matilda infantry tanks, also operated about a dozen Light Tanks Mark VIB between them, which were used as headquarters and liaison vehicles. 2nd Lieutenant Peter Vaux of 4th RTR has an amusing and telling story to tell of his experience during the battle of Arras on 21 May 1940:

> I remember a silly thing that happened as we went back along that road. Some small anti-tank gun fired on my Light Tank and a shot went in through the left of my turret, just behind my gunner's head, and out through the right side of the turret just behind my head – I suppose we both turned a bit pale. Then, without a word, the gunner bent down, brought out his small pack, opened it and took out a very smelly pair of socks. He handed one to me; the other he stuffed into the hole on his side and I stuffed mine into the hole on my side! Somehow or other we felt much safer like that!

British 1st Armoured Division was landed in western France on 22/23 May 1940. It was supposed to move east and link up with the rest of the British Expeditionary Force across the river Somme, and was intended to consist of six tank regiments, mostly of cruiser tanks, but with approximately 22 light tanks each. However, in the event only the 3rd Royal Tank Regiment got across the Somme. It was sent independently to Calais, where it was all but destroyed. However, shortly after arrival it did manage to send a light-tank patrol to St Omer, which, finding nothing there, returned to Calais. A few light tanks also took part in a breakout to Gravelines, although the majority seem to have been disabled protecting the port.

Meanwhile, further west, the remaining five armoured regiments of 1st Armoured Division advanced to the Somme only to find the Germans in possession and the area heavily defended. They were later joined by 1st Lothian and Border Yeomanry, one of the light armoured reconnaissance regiments then attached to 51st (Highland) Division, which fought until it was wiped out on the retreat to St Valery. Surviving histories of the division concentrate upon the activities of the cruiser tanks and the final event, in which light tanks are recorded as participating in the long-distance cross-country run by the surviving elements of 3rd Armoured Brigade, the RTR brigade, under Brigadier J.T. Crocker. A dozen light tanks, out of 14 that started, made it all the way to Cherbourg just ahead of the Germans. According to one source, the light tanks attached to 1st Armoured Division were of the Light Tank Mark VIC model whereas those with 1st Army Tank Brigade and the divisional cavalry regiments were Mark VIB. This would make sense, because many of the cruiser tanks with 1st Armoured Division were also armed with Besa guns, but it cannot be confirmed entirely, and some may have been Mark VIBs.

One other event of a warlike nature from around this time concerns the 3rd King's Own Hussars. On 6 May 1940, 17 men from this regiment with three light tanks were shipped to Norway from Leith on the Polish liner *Chobry*. They were originally destined for Harstad, but the *Chobry* was diverted from there on the 14th,



A Light Tank Mark VIB from an unidentified regiment is seen crossing a temporary trench bridge. It sports the white–red–white national recognition sign in use at that time, on the front sandguard and on the side of the turret. The trigger mechanism on the smoke discharger has been shrouded, but the main armament seems to be ready for action.

after landing most of its troops, and sent south towards Namsos with the men and tanks of the 3rd Hussars on board, along with 1st Battalion the Irish Guards. The ship was bombed relentlessly by the Germans and set on fire. The men were taken off by the Royal Navy escort, which then had to sink the blazing *Chobry*, which went to the bottom with the three tanks. Captain Tyrell, the officer commanding the 3rd Hussars detachment, wrote: 'What their story would have been had their tanks landed in a country where the only roads were precipitous goat tracks can only be conjectured.'

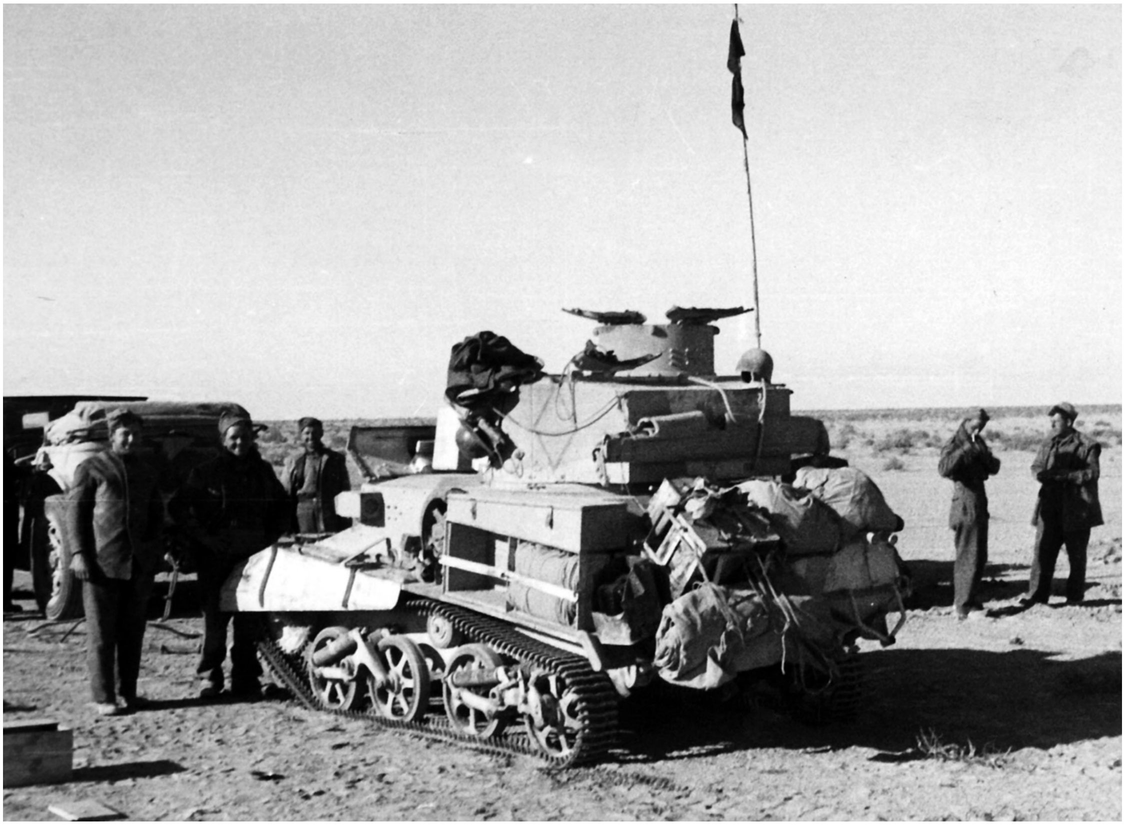
A few light tanks, reportedly six, had their suspensions modified to provide a steadier gun platform. This was done by fitting two double bogies on each side, facing back to back, with a separate idler wheel and two return rollers on each side and extra shock absorbers fitted to the suspension units. One at least was converted from a Mark VIA, while others are said to have been based on the VIB. In the case of the Mark VIA the turret was like the Indian Pattern, without a raised cupola but with a nearly flush hatch instead. Whether this was true of all the tanks so modified is not at all clear. It is said that this gave the tanks a much steadier gun platform, but, as they found in France, the armament on these tanks was regarded as almost useless, so there was no point in the conversion. Some of these tanks are believed to have accompanied the 1st Armoured Division to France in 1940.

Any attempt to catalogue all the armoured regiments and other units in Britain that had Light Tank Mark VIs in the immediate post-Dunkirk period was almost certainly doomed to failure, and would probably have included all of them, since the Light Tank Mark VI was by far the most common type of tank available. All we can hope to do is to concentrate on a few of the more interesting units and make some general points. For instance, before it was sent across to France in May 1940, the 1st Armoured Division, or at least the two brigades that would form it, was distinctly different, although it was seen as being complementary. In the original plan, 2nd

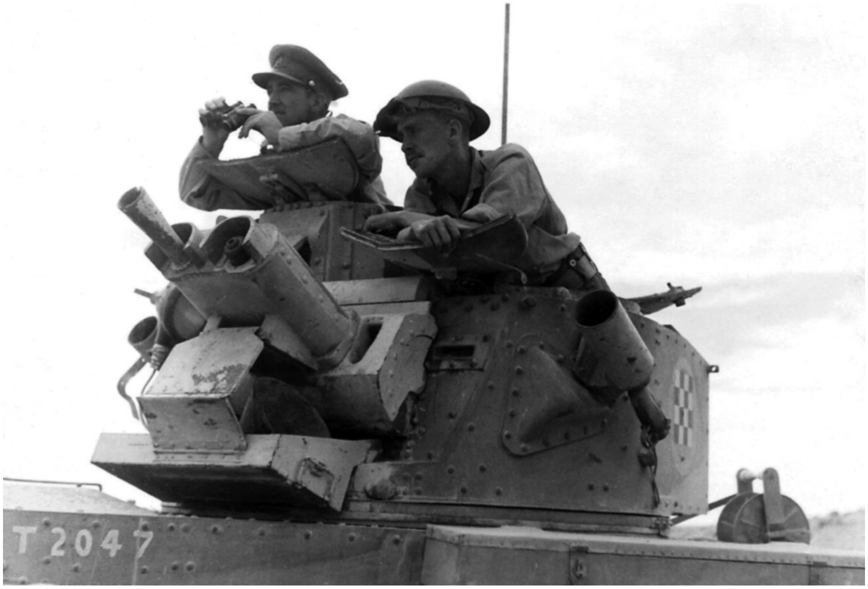
Armoured Brigade, composed of three cavalry regiments, was designated as a light brigade to be equipped exclusively with light tanks, while 3rd Armoured Brigade, formed with three RTR regiments, was to be equipped with cruiser tanks. In the event, before they left for France the decision was taken to mix them up and create six regiments, each with a portion of cruiser tanks and the balance made up from light tanks, which were deemed to be ideal for reconnaissance, command and liaison duties. This was particularly hard on the cavalry regiments, whose men needed to learn the intricacies of the cruiser tanks very quickly to ensure that every regiment in the division had some tanks capable of fighting other tanks.

The British abandoned huge numbers of light tanks when they pulled out of France, along with many others. At first glance the light tanks would not appear to be a lot of use. The German models were better, and even they were regarded as something of a liability following combat experience in France. However, even the British light tanks had a workable and reliable chassis, so a German officer stationed in France, Alfred Becker, initiated a comprehensive rework programme for local use. He came up with quite an effective AFV design with a built-up, open-topped superstructure mounting a French 105mm gun that could be operated by a crew of four. It went into such details as a pivoting earth anchor at the rear to provide stability when firing. There was even a command version with an enclosed superstructure surmounted by a small cupola. Classified as Pz Kpfw Mark VI(e) mit 105mm le FH16, it proved that although it was almost useless as a fighting tank, the Light Tank Mark VI could form the basis of a serviceable self-propelled gun – something the British might have been able to work out for themselves. Even so, the German

Any attempt to carry all the comforts of home on your tank was a tricky business, especially if you only had a Light Tank Mark VI. The stowage box and rack on the left trackguard was a standard fitting, as was the rack for extra fuel and water cans at the back, but there was nowhere to stow tents, groundsheets or bedding rolls; they had to be hung from the back as shown here.

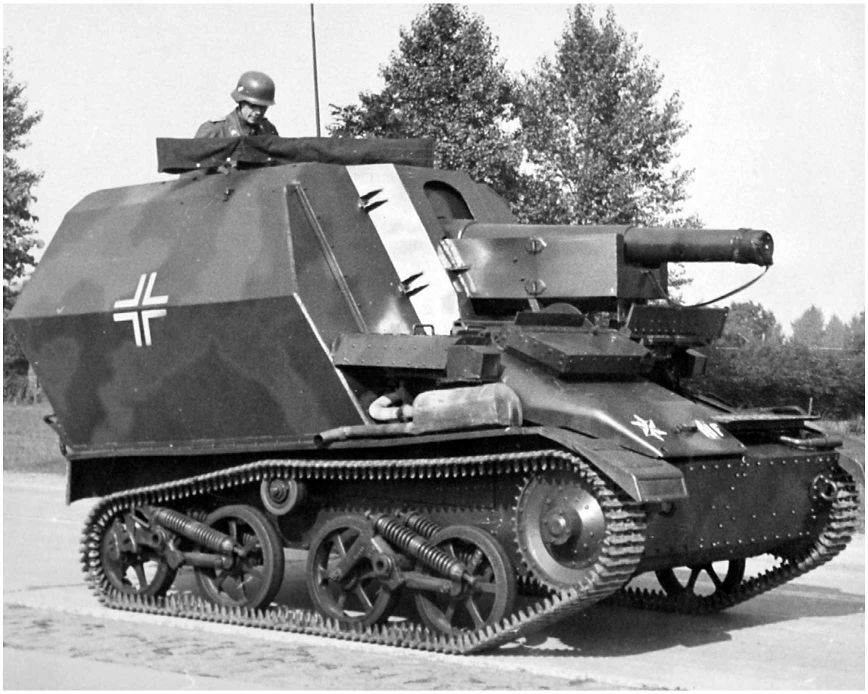


A Light Tank Mark VIB in use as an armoured observation post by the Royal Artillery. It can be identified by the cable reel on the back, the chequerboard device on the side of the turret and the way the officer and NCO are scanning the battlefield.

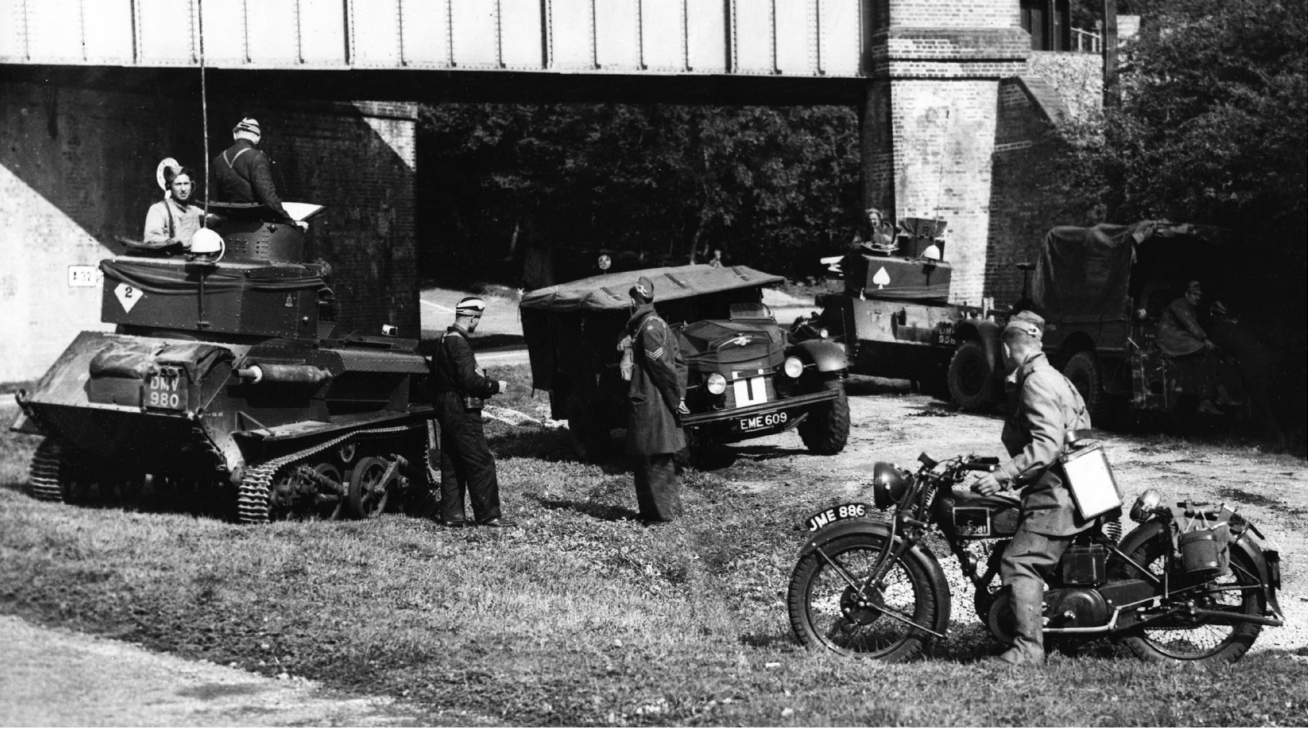


conversions probably did not last very long, and seem to have remained in France on internal security duties.

After the fall of France, when the 1st Armoured Division was back in Britain, one of its armoured brigades, composed of just two regiments, could muster only 81 cruisers and 100 light tanks, although they were better off than the newly formed 2nd Armoured Division, which could manage only 178 light tanks, instead of the mixture of cruisers and light tanks it should have had on paper. This was probably



Major Alfred Becker is credited with this design, the le FH16, which used the hull of the Light Tank Mark VIB to carry a 105mm howitzer. Becker established a plant in France and built about 50 of these on captured British tanks. The armoured superstructure housed three members of the crew, behind the driver. The gun was an old one, more commonly seen on a two-wheeled carriage.



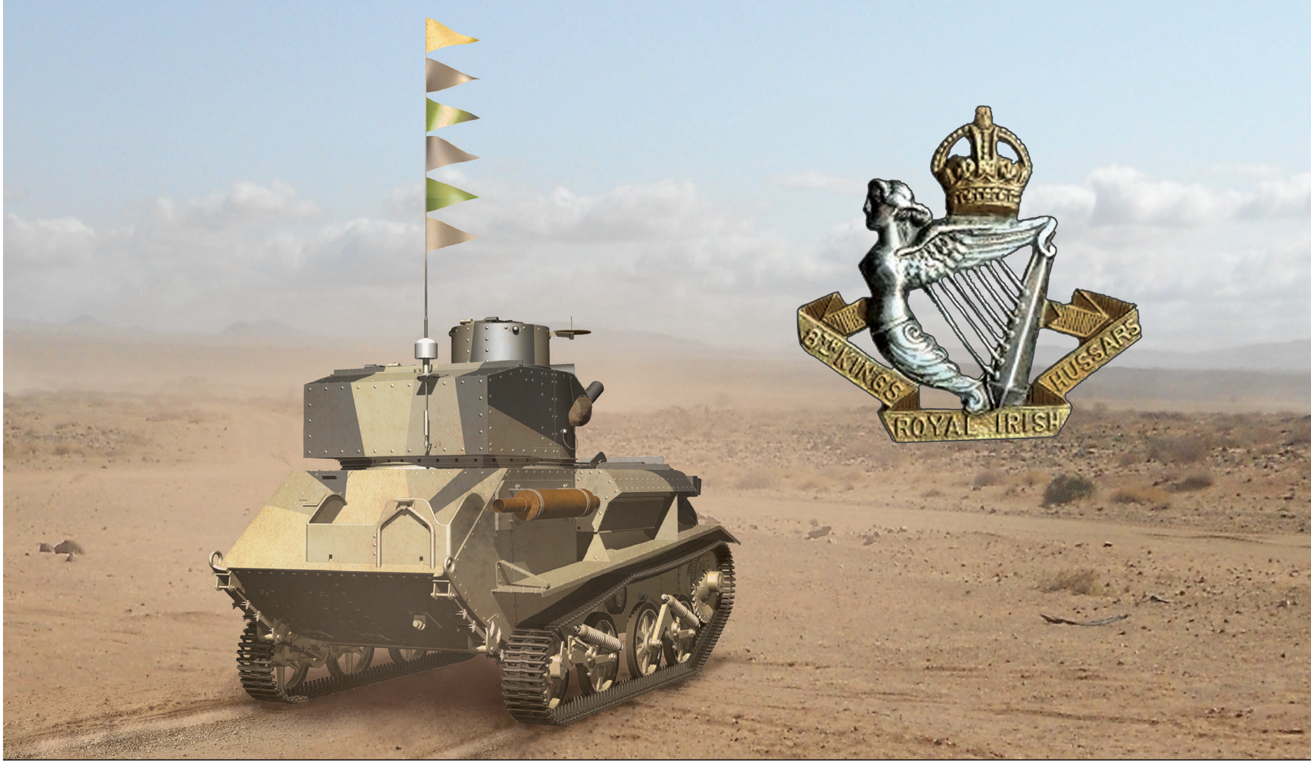
A pair of light tanks covering a road junction by a railway bridge during an anti-invasion exercise in southern Britain. The tanks belong to a mechanised cavalry regiment, which seems to have adopted playing-card symbols to distinguish individual squadrons.

typical for all regiments, those already formed and those newly forming, but it was unavoidable at the time and probably did not last very long, after more suitable tanks became available. On the other hand, Royal Armoured Corps training regiments seem to have retained some Light Tanks Mark VIB until 1942. The 51st Training Regiment based at Catterick certainly did, and probably the 56th at Bovington too. One retired officer, an NCO at the time, tells of how in the event of invasion he was expected to collect a Light Tank Mark VI from the driving and maintenance school, take it to the armoury to be armed and then to the wireless wing to collect a wireless set, before sallying forth to deal with the invading Germans. However, if we can base our information on photographic evidence, then one of the biggest users of light tanks, even including some Mark IV tanks as well as Mark VIBs, was 102 Officer Cadet Training Unit, then a function of the Westminster Dragoons, which undertook extensive training in the Sandhurst and Blackbush area of Surrey.

Incidentally, some 50 light tanks, part of a commercial order by Vickers-Armstrongs for the Dutch Army, were still in Britain at the outbreak of war and were appropriated for the British Army. Designated officially as Mark IIIB, but known as Dutchmen, they were allocated for training. However, some of them, on the special instructions of the prime minister, were passed on for use by the Greek Army. All those that survived eventually ended up in second-line service with the German Army.

THE MEDITERRANEAN THEATRE

Listing the regiments that operated the Light Tank Mark VI is almost pointless, and probably impossible. They include the tank battalions of army tank brigades, which had a handful attached to battalion and squadron headquarters of certain regiments, such as the 3rd Hussars, the 4th Hussars and, initially at least, the 7th Hussars, which was equipped exclusively with light tanks. The majority of RAC regiments, at least in the first two years of the Desert War, seem to have been organised on a more generous basis as far as light tanks were concerned. Proportions up to about 50:50 appear to



LIGHT TANK MARK VIB, NAVIGATOR'S TANK, 8TH HUSSARS, WESTERN DESERT

One of the more colourful tanks in the Western Desert, this regimental navigator's tank displays an array of coloured pennants on the wireless aerial; the colours changed from day to day. Some units preferred this method of identification to the alternative – either a blue flag or a long black one – believing it to be less obvious to the enemy. The officer responsible for navigation was a key figure in the desert, it being so easy to get lost. He relied on a sun compass, on a bracket to the right of the cupola, to steer an unerring course over the featureless landscape. It was a more certain system than relying on the skills of numerous individuals. Notice also that the rear part of the smoke discharger on the turret side is wrapped in cloth to protect the mechanism from sand; this is because this component was taken from the breech section of a bolt-action rifle.

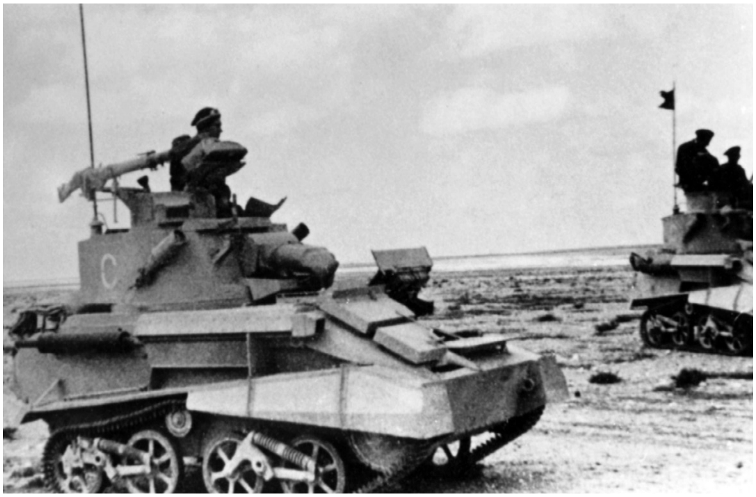
Otherwise the tank is a typical Mark VIB, although many light tanks had additional stowage added to the left side and on the rear hull. In 1941 the 8th King's Royal Irish Hussars, to use its full title, was the second senior regiment in 7th Armoured Brigade, itself at that time part of 7th Armoured Division, but it depends whether it was the senior brigade in the division or not. When it was the regimental arm of service, the marking would be '25' in white on a red square, but if not it would be '29' on a green square. To avoid confusion the tank in this illustration carries no arm of service identification on the back at all. (Art by Henry Morshead, © Osprey Publishing)

have been common, and that would apply to most of the regiments serving in that theatre at the time.

The 1st (Light) Battalion, Royal Tank Corps, was sent out to Egypt in October 1935 to add its strength to the tank forces already out there, limited as they were, during the Abyssinian crisis. They were equipped at the time with Light Tanks Mark VIA and remained out there until October 1936, to the detriment of tank brigade training in Britain for that year.

The battalion returned to Egypt in 1938, now equipped with Light Tanks Mark VIB complete to its establishment total of 52 tanks. It formed part of what was originally known as the Mobile Division (Egypt), which later became the famous 7th Armoured Division. It was formed under the command of Lieutenant-Colonel P.C.S. Hobart, but was initially woefully short of tanks.

Among the regiments already out there was the 7th Hussars. It had a selection of Light Tanks Mark III, Mark VIA and Mark VIB, but only sufficient to equip two



Light Tanks Mark VIA of C Squadron, 1st Battalion, Royal Tank Corps, on outpost duty in the desert, just before the war. A Lewis gun is fitted, attached to a bracket on the commander's cupola. All weapons appear to have been covered to keep out sand, but the driver's hatches are wide open.

squadrons; even then no heavy (.50in) machine-gun ammunition was available for the Light Tanks Mark VI, so they could only use their .303in machine guns.

The 7th Hussars was converted from horsed cavalry to a fully mechanized regiment after it arrived in Egypt, shortly before the war. It was issued with a mixture of light tanks, mostly of the Light Tank Mark VI variety. Its men make the point that the life of a tank in the Middle East was measured largely by the longevity of its tracks, and that since the tracks on most light tanks were very nearly worn out, they did not expect much of them. Once they had settled in and got used to their tanks they repeatedly heard rumours that heavier cruiser tanks would be arriving from Britain to replace them, but these remained only rumours for some time. When at last some heavier cruisers did turn up, many without guns, to begin with the 7th Hussars received only enough to equip A Squadron. The other two squadrons went to war in their light tanks.

It has been said that when these light tanks were designed and first issued, the general belief in the British Army was that tanks were unlikely to fight other tanks, so machine guns and thin armour were considered perfectly acceptable. This assertion needs to be treated with care. Even back in the days of the old medium tanks, firing on the move was standard practice, and when the 2-pdr gun was introduced in 1936 it was almost exclusively meant for firing against other tanks. Of course, when the light tanks were first introduced they were seen as glorified armoured cars, and often used against forces that were not armed with tanks or vehicles of any sort. And of course, when the three-man light tank was introduced, from about 1935, its armament was improved by the addition of a .50in heavy machine gun, because then it was regarded as a weapon capable of dealing with other light tanks and armoured cars.

The 7th Hussars took part in most of the early actions in the Western Desert, from the successful attack on Fort Capuzzo on 14 June 1940, to the assault on Tobruk in January 1941. In the first action they borrowed two Light Tanks Mark VIB, one each from 1st and 6th Royal Tank Regiments, the reason being that these tanks were fitted with powerful spotlights that were considered vital for use at night. They were also in the van on the difficult cross-country journey to Beda Fomm. The going was particularly unpleasant, with areas of slab rock and large boulders that reduced speed and increased petrol consumption to an alarming rate, not to mention the difficulty of negotiating areas strewn with Thermos bombs, which could damage tracks and suspension, albeit without harming the crew. The regiment arrived at Beda Fomm on 5 February and at once went onto the attack, capturing and destroying a number of Italian lorries.

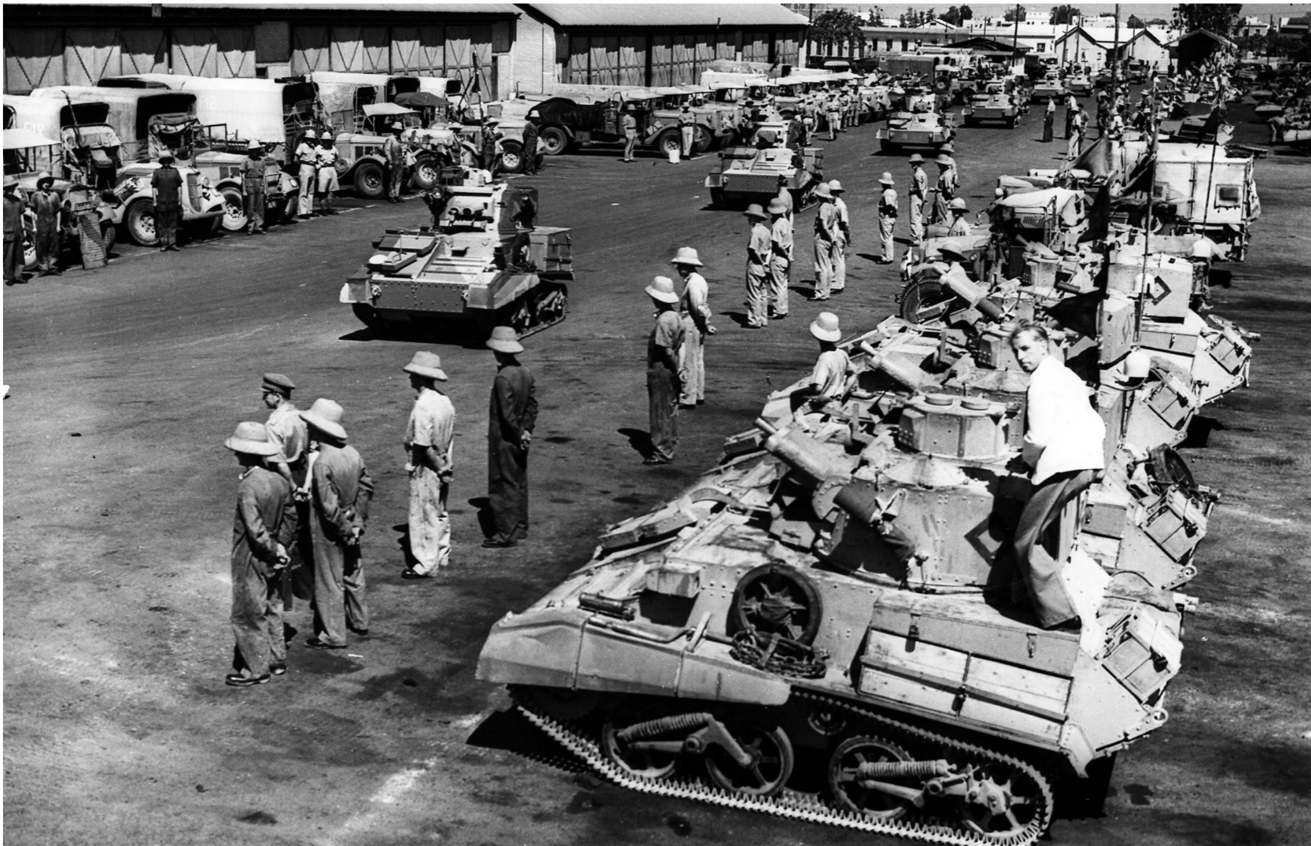
Meanwhile, the 8th Hussars was making do, operating as a light car regiment equipped with American Ford V8 pick-up trucks, each armed with a single Vickers-Berthier light machine gun. The 8th Hussars, more fully the King's Royal Irish

Hussars, started to receive light tanks early in 1939, or what they describe as cast-offs from the 7th Hussars and the 6th Royal Tank Regiment. These included seven Mark VIBs and 11 Mark IIIs, which were of course two-man light tanks armed with a single .303in machine gun, but by the end of April they had enough Mark VI light tanks to equip A and B Squadrons, while C Squadron had to make do with the Mark III. Later still, however, C Squadron was rewarded with two troops of Light Tanks Mark VI and two troops of the new A9 cruiser tanks.

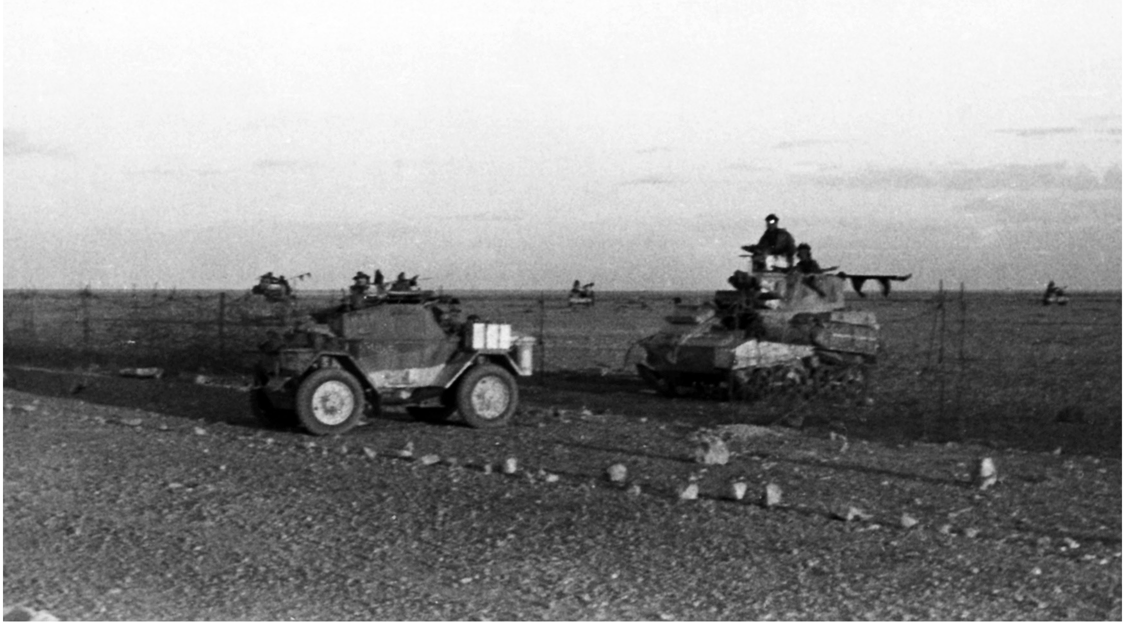
However, just to prove that not all of the actions initiated by the British Army against the Italians were successful, it is necessary to recount a few details of the raid mounted by the 8th Hussars against the Italian camp at Maktila in October 1940. Maktila was the most northerly of a series of camps established by the Italians as part of their invasion of Egypt in the late summer of 1940. Indeed, Maktila was so far north it was virtually on the coast, and was occupied by the 1st Libyan Division of the Italian Army.

The attack on Maktila was mounted at night, on 23 October 1940, by the 8th Hussars and 2nd Battalion the Cameron Highlanders. Making a stealthy approach – the Camerons leading on foot backed up by the light tanks of the 8th Hussars, which dared not come in too close for fear of suspected but unidentified minefields – the British were met by withering fire from every weapon the Italians could muster. The British attack had been anticipated, and the tanks and infantry had to withdraw. As dawn broke the 8th Hussars also came under attack from an armoured column of about 20 vehicles that emerged from the Italian camp at Tummar East, further south, and were unable to fight back since their tanks were cluttered up with Scottish infantry. They were obliged to withdraw, thankfully with no casualties.

The 3rd Hussars arrived in Egypt in September 1940, having come directly from Britain complete with their light tanks. Shortly after they landed, the regiment



Abbassia Barracks, Egypt, and the 8th Hussars on parade with their Mark VIA light tanks just before the war. They were issued with badly worn tanks, previously used by the 6th Royal Tank Regiment and the 7th Hussars. Up to that time the 8th Hussars had been mounted in American Ford V8 pick-up trucks.

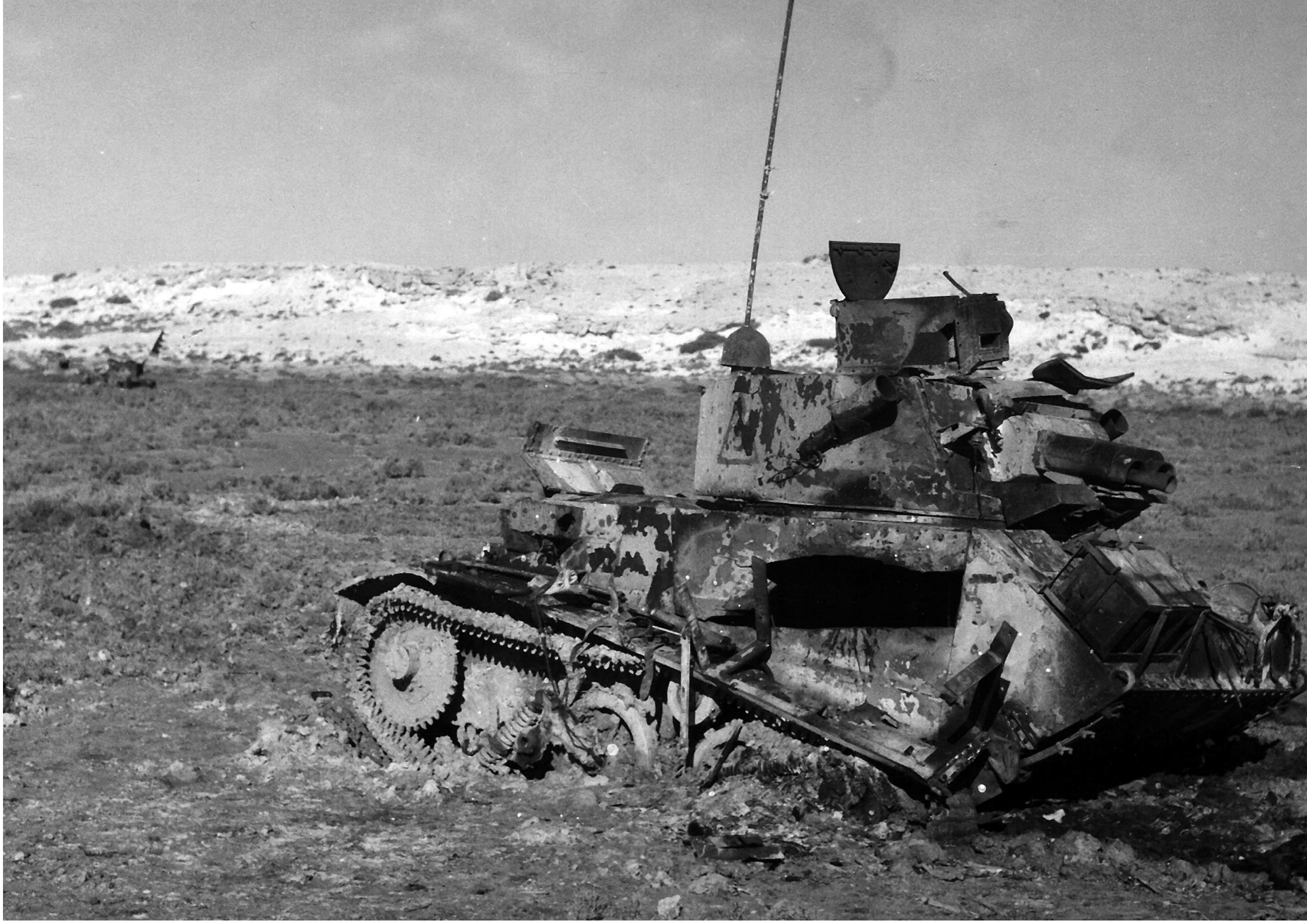


A Light Tank Mark VIA follows a Daimler Dingo Scout Car through a gap in the wire into what looks like a tidily laid out British camp in the desert. The light tank appears to have its wireless aerial folded down in order to reduce its silhouette, but it carries no visible markings, so it is impossible to tell the regiment to which it belongs.

exchanged their B Squadron with the 2nd Royal Tank Regiment so that the 3rd Hussars had at least one squadron of cruiser tanks, albeit manned by 2nd Royal Tank Regiment. However, their first action saw the virtual destruction of one of their remaining light-tank squadrons. The light tanks had been directed against Italian positions near the coast following the battle of Sidi Barrani. A Squadron dashed forward in line ahead and swung into line abreast to attack the Italian position. Unfortunately, between them and the Italian defences lay an area of salt marsh, just to the west of Buq Buq. One after another the light tanks bogged down in the marsh, to be destroyed by the Italian guns. All told the regiment lost 13 tanks, the best part of a squadron, and the matter was not finally settled until the cruiser-tank squadron moved in and wiped out the guns. But by then it was too late for A Squadron.

Probably because there were so many of them, as much as for any other reason, Light Tanks Mark VIB turned up all over the place, although they were of palpably little use. Indeed, one even accompanied B Squadron, 4th Royal Tank Regiment, to Eritrea at the start of 1941. This squadron, otherwise equipped with 16 A12 Matilda tanks, was sent there to bolster an Indian infantry force that was attempting to defeat the Italian garrison. For the tanks it was as much a struggle against poor roads and rugged countryside as against the Italians, and although they were in action on a number of occasions they spent a lot of their time moving from place to place with great difficulty along mountain tracks that severely tested the transmission of the infantry tanks. For some reason they received 16 tons of spares for their one light tank and none at all for the Matildas, which they had to keep going by cannibalization.

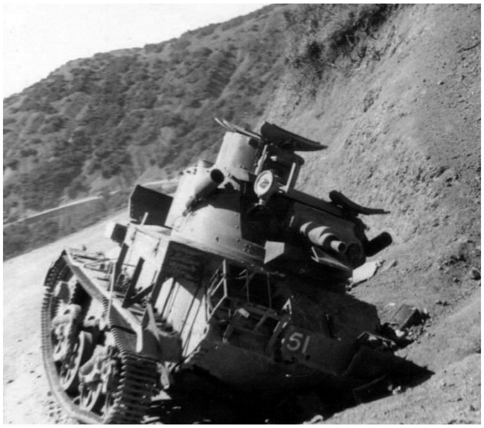
Winston Churchill's old regiment, the 4th Hussars, was sent to Greece as part of 1st Light Armoured Brigade Group. It was equipped exclusively with Light Tanks Mark VIB, while the other armoured regiment in the brigade group, the 3rd Royal Tank Regiment, was armed with cruisers. When the German attack began early in the morning of 6 April 1941 the armour was out in front, ready to receive them. But it soon became clear that the light tanks, armed only with machine guns, could not



One of the Mark VI tanks shattered by Italian artillery when it became bogged down in the salt marsh at Buq Buq. The 3rd Hussars lost the best part of a squadron here on 12 December 1940 when it impetuously attempted to follow up the Italian retreat by charging across unstable ground in the face of determined artillery fire.

destroy German armour – they could delay it for a while by judicious use of ground, but not hold it up forever. That required tanks or anti-tank guns, in both cases the hard-hitting 2-pdr weapon. To begin with the Germans could not tell whether it was light tanks, cruiser tanks or anti-tank guns that were firing, and treated all three with equal respect. However, once they had sorted out the sheep from the goats, as it were, and appreciated that the light tanks were virtually no threat to their armour, they dealt with them accordingly. In the end it was the long and continual retreat with no time to halt for maintenance, over rough roads and tricky mountain passes that wore out the tanks. By the time the 4th Hussars had crossed the Corinth Canal and proceeded by a roundabout route through the Peloponnese to the proposed embarkation port at Kalamata they were reduced to just ten tanks, which were soon bombed out of existence, leaving the survivors to fight on foot. By the end of April it was virtually all over – a number of crews got away, but the tanks, by then all wrecks, had to be left behind.

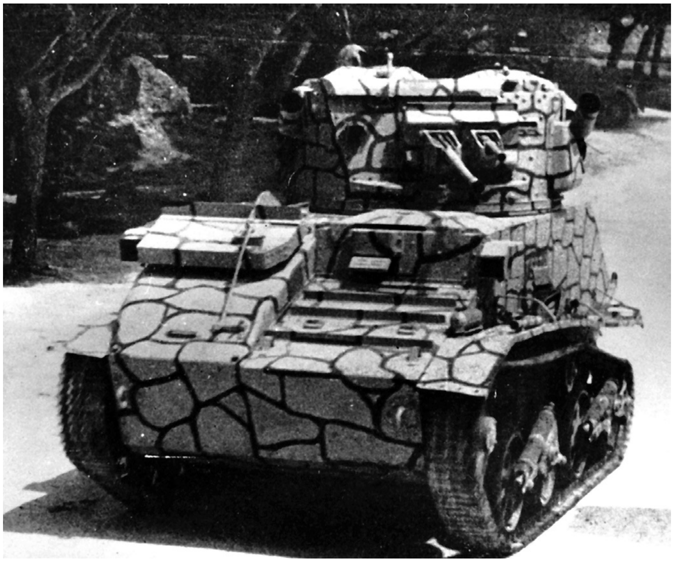
A short while later, on 11 May 1941, C Squadron, the 3rd Hussars, with 16 Light Tanks



A Light Tank Mark VIB with all hatches open, which has come to grief off the road in Greece. It belonged to the 4th Hussars. The turret has been traversed to the rear and it is possible to make out the turret-mounted spotlight alongside the gun mantlet. The arm of service marking for 4th Hussars is the number 51 in white on a red square.

Mark VIB, was sent to bolster the defences of Crete. It was another forlorn hope for the 3rd Hussars, who were obliged to destroy all their surviving tanks by the end of the month, while the survivors escaped from the island as best they could. Nine A12 Matilda tanks of 7th RTR were also sent to Crete. However, in the long run, the regiment had little to show for its efforts and had to abandon the tanks on the island.

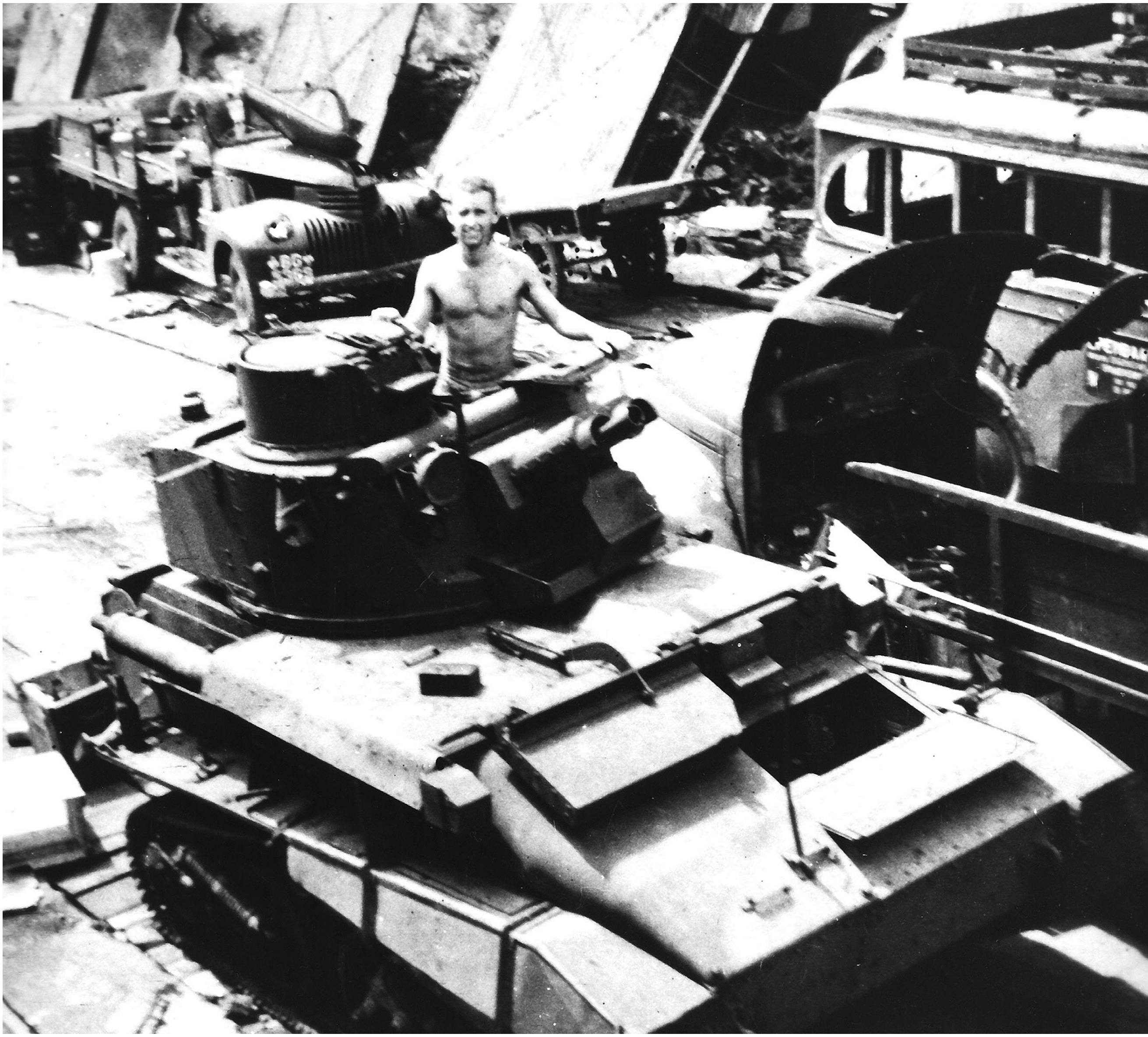
Malta, on the other hand, was a relatively peaceful location, if you overlook the air raids. At least there was no fighting on the ground. A variety of tanks were posted there at different times, including some Light Tanks Mark VIB and VIC, mostly operated by a troop from the Royal Tank Regiment that seems to have been known by a variety of titles. The most distinctive thing about the tanks on Malta was their camouflage scheme. It appears to have been a sort of 'crazy paving' pattern of brown lines painted over typical desert stone, intended to disguise the tanks against the background of dry stone walls that were a feature of the island.



A tank finished in the exotic Maltese camouflage. This is a Mark VIC with two air-cooled Besa guns replacing the Vickers. It also features a turret without a cupola, but in every other respect it is identical to a Mark VIB. The camouflage, which was supposed to disguise the tank against a local stone wall, features light stone-coloured paint, broken up into 'crazy paving' shapes with light-brown lines.

Further east, a few light tanks were stationed for a time on Cyprus. The force, which was equipped with Light Tanks Mark VIB, Universal Carriers and 15cwt trucks carrying 2-pdr anti-tank guns was provided by the 7th Australian Divisional Cavalry Regiment, which had the difficult task, pending an expected German landing, of trying to simulate a much larger force by patrolling all over the island with crews wearing different hats. It was there from May until August 1941, after which the threat of invasion diminished. The regiment was then transferred to Syria. Here it largely replaced the 6th Australian Divisional Cavalry Regiment, and encountered the 9th Australian Divisional Cavalry Regiment, similarly equipped with Light Tanks Mark VIB and Universal Carriers, which had seen action against Vichy French forces equipped with Renault R35 tanks. Although relatively small, these were much better armed and armoured than the British light tanks, and in tank-versus-tank terms there was no contest. Even so, the Australians, by clever use of their equipment, ultimately managed to defeat the French forces and capture two of the Renault tanks in the process, which they proceeded to use against their former owners.

It seems that the 3rd Hussars were destined to be tied to their light tanks for years, and to be sent on some almost suicidal missions with them. Following their attempted intervention in Norway in 1940 and their equally brave but ultimately pointless excursion to Crete in 1942, they were now destined to become involved in an even more fruitless attempt to save Singapore, in 1942. This time it was B Squadron, commanded by Major P. William-Powlett, that sailed from Egypt in January 1942. In fact the squadron had reached Sumatra only two days before Singapore surrendered, and by the time it had unloaded its tanks and prepared them for action it was ordered to sail with them again for Java. This voyage was epic in itself, since most of the tanks were loaded aboard a Dutch steamship while the balance of eight tanks had to be loaded onto a lighter and towed to Java by a tug.



The 3rd Hussars again, this time with a Light Tank Mark VIB, photographed on the dockside in Java. There was not a lot that could be done with tanks such as this, but throwing them away on what we now know was such a futile expedition, and losing the men with them for the rest of the war, seems little short of insane.

Even so they got there and unloaded their tanks at Batavia, where they undertook some tank training in the unfamiliar surroundings of jungle and paddy fields.

Following the disastrous battle of the Java Sea, Japanese forces invaded the island and B Squadron, the 3rd Hussars was incorporated into 'Blackforce', commanded by the Australian Brigadier Blackburn VC, and stationed at Buitenzorg. Blackforce, which included American artillerymen and Australian infantry, saw some action against the Japanese, but it later learned that the Dutch authorities had decided to surrender and thus ultimately, in obedience to orders, were obliged to deny their tanks to the invaders by pushing them off a mountain road into a deep ravine with a fast-flowing torrent at the bottom. None of the men escaped; all became prisoners of the Japanese. It was the end of their fruitless adventures as far as the rest of the regiment was concerned.

SUMMARY

In 1942 the retired soldier Vivian Loyd, once half of the erstwhile Carden-Loyd team, came up with his design for an air-portable light tank. It had many features of the earlier Vickers-Armstrongs light tanks, such as the suspension and front-mounted drive sprocket. The only difference was that it was right-hand drive, with the engine on the left, and apparently of an all-welded construction, but it was surmounted by the tiniest turret imaginable, capable of mounting only a single machine gun. Had Loyd really learned nothing over the intervening years? His tank attracted no interest from the authorities at all. At least they knew better, or rather had finally learnt something.

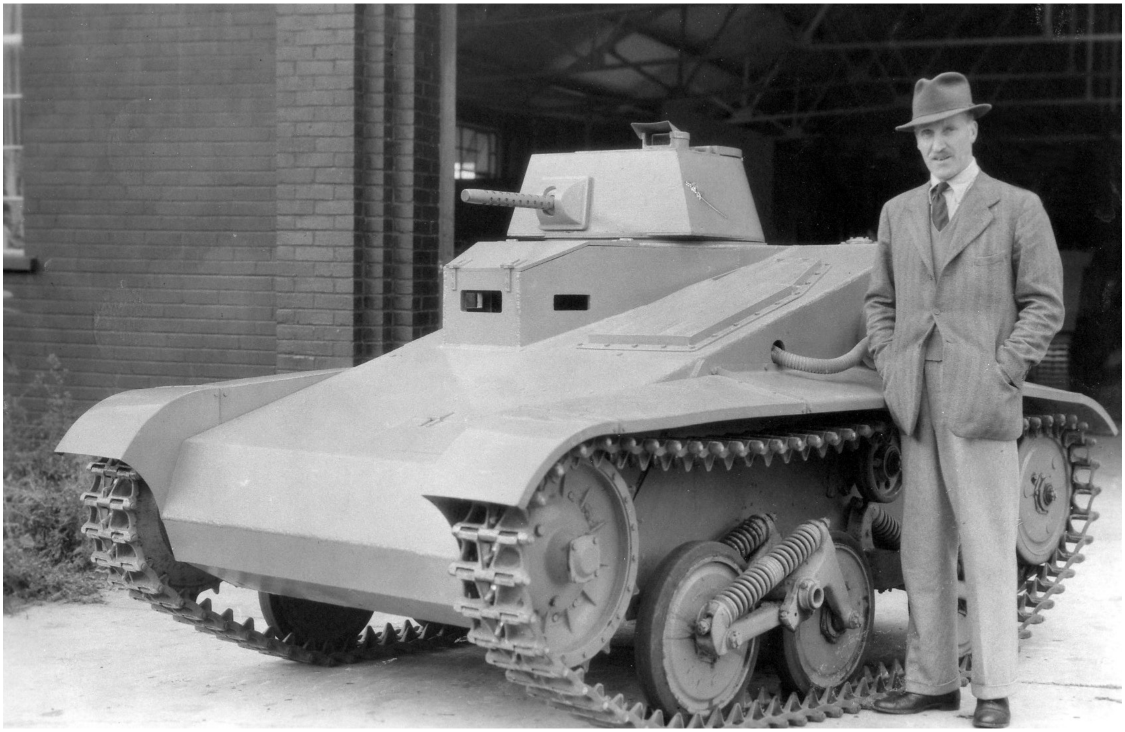
In fact there was no place for light tanks armed only with machine guns in the armoury of a modern army, and probably never had been. For a country such as Britain, with huge colonial responsibilities, often in countries inhabited by truculent tribes, light tanks had their uses, but that did not mean they had any value in modern armoured warfare, as was soon made clear. If something could have been done, as indeed it was experimentally, to fit a more powerful anti-tank weapon to those tanks destined to fight in the west, it would at least have given them a chance, but sending them off to war with the same weapons used to subdue tribes on the North-West Frontier was akin to madness. However, the light tanks did have two things going for them: they were relatively cheap to produce, and they were fairly reliable. But since they carried no weapon more powerful than a heavy machine gun and were vulnerable to the most basic of anti-tank weapons, they were doomed.

Looked at from this distance, it seems as if the British were predisposed to start off on the wrong foot, due to their colonial heritage, but it has to be said that they learned quickly enough, albeit to begin with they were hampered by industrial limitations. Yet it is interesting to note that when a new light tank did appear, the Tetrarch in 1940, they seem to have been reluctant to employ it as such, and when first introduced to an American light tank in 1941 they initially classed it as a small cruiser.

The truth is that in the environment of armoured warfare the light tank will always be vulnerable, unless it can rely on its mobility, but if it is equipped with a respectable anti-tank weapon at least it has a chance. Those light tanks that equipped the British Army in France and later in the Western Desert and elsewhere were entirely unsuitable for the role. They were the successors to a long line of light tanks developed in the insularity of harmless war games or in the unrealistic atmosphere of colonial policing, neither of which fitted them for combat in a real European war when it came.

The idea that such tanks could have any part to play in post-war events seems to be ludicrous on the face of it, yet Britain, when it finally finished with the Light Tank Mark VI, passed most of them on to the Egyptian Army, possibly in the pious belief that they would be used only for training or perhaps for internal policing duties. But in this they seriously underestimated, as most people did, the impact of the creation of a Jewish homeland in the Middle East, the formation of the state of Israel and the virulent if disjointed Arab reaction to a lively Jewish settlement in their region.

As a result, when the Egyptian Army mobilised against Israel it did so with whatever tanks it had available: some Matildas and Valentines, a few Shermans and of course a quantity of Light Tanks Mark VI. At first they had to deal only with Jewish resistance groups armed with nothing better than improvised armoured lorries, against which even the Light Tanks Mark VI had some potential, but with the



Vivian Loyd photographed with his prototype light tank, which he built at his own expense in 1942. What prompted him to do this is not obvious, but it was offered as an airborne light tank. What it might have achieved on the battlefield, armed with just one machine gun, is not at all clear.

creation of the state of Israel in May 1948, and the gradually increasing strength of the Israeli Defence Force with an equally heterogeneous collection of armoured vehicles, the Egyptian Light Tank Mark VI was really challenged. Even so, the Egyptians continued to deploy the type wherever they could until the early 1950s, when Britain undertook to modernise the Egyptian Army, and when the old and useless light tanks were finally scrapped.

There seems to have been one final fling. At some stage the Israelis also acquired or captured a Light Tank Mark VIB, which they rearmed with a heavier automatic weapon. However, what remains of it is now found in the Israeli Armoured Corps Memorial and Museum at Latrun. There are, in fact, quite a few surviving Mark VI tanks in different parts of the world, with at least one in Australia, one in Canada, two in the United States and two in Britain. They are worth a visit should anyone need reminding what these compact, strangely elegant and almost totally useless armoured fighting vehicles look like.

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